THE FOUNDRY

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A Wrinkle.

BY W. H. KREMER.

Two years ago a customer desired to have made a lot of "whiffletree hooks and ferrules," of his own design, and of malleable iron entirely, expecting, as one naturally would, at less cost than those that are partly made of wrought iron. The eye ferrule, in the latter case, being made of malleable with a wrought iron hook formed and fastened to it afterwards. Shops that make a specialty of this class of goods are provided

Fig. 1

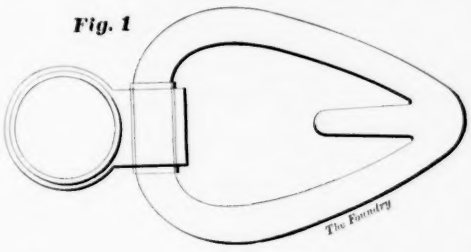
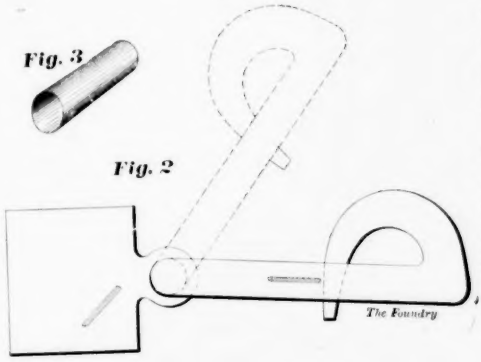


Fig. 3

Fig. 2



with very ingenious tools, have a systematic piece work system and can produce them at a comparatively low price.

The proposition at hand, according to rules of ordinary foundry practice, required the making of two gates of patterns, one for the hooks, another for combined hook and ferrule. Then to cast the hooks first, coat them with sand where they pass through the eye of the ferrule, and place them in print of mold of combined hook and ferrule pattern.

On casting same the sand coating on hook would prevent the adhesion of the fluid iron on passing over it, and allow sufficient play for its proper working within the eye of the ferrule.

Anticipating the cost of such a method and knowing the prevailing competition in these goods, led me to the idea of casting both hook and ferrule at one operation, thereby saving the expense of making the hooks.

In carrying out this idea, a combined hook and ferrule pattern, Fig. 1, was made, with gates (see shaded lines Fig. 2) carried to both the hook and ferrule part. A sheet tin tube, Fig. 3, ¼ inch longer than eye of ferrule of same diameter as hook where it passes through the eye, perfectly round, and butt jointed (not soldered) was provided. These tubes, by the way, for first lot, cost $1.25 per 1,000. They were coated with sand on the outside, in the usual way, and placed in the mold extending through the eye part of the ferrule. The print of hook at that point forming the print to hold the tube in place, allowing ⅛ inch bearing at each end.

In casting, the iron will run over and through the tube at the same time without changing the form of the tube, enabling, by virtue of the sand coating, a parting to exist between the two castings, when, after cooling, the two castings will work free and easily. The tube will be found to be welded fast to the hook.

Care must be taken in using binding material (shellac, etc.) in coating the tubes. Too much is likely to cause a blowhole in the casting, otherwise there is no trouble in turning out perfect work by this method.

Although making a success of the method, the cost of production was not brought down to the point which enabled a competition in the market with those ferrules furnished with wrought iron hooks. The prejudice existing against the wearing qualities of malleable iron, necessitating a lower selling price to favor its adoption by the trade.

The "wrinkle" is given for what it is worth; it may fit some other case as well as it did this one. Would not advise the use of ordinary sheet tin for castings over one-half inch in diameter, as the castings remain fluid too long for the tube to retain its form, which condition is necessary to secure the proper working of the parts. Heavier tin, iron or even pipe can be used to accomplish the purpose.

Feeding Castings.

By R. D. MOORE.

The writer, many years ago when a young jour was impressed with the importance of knowing the true principle of feeding castings after pouring, or in other words, what device in feeding gates gives the longest, and therefore the most perfect feed.

I reasoned out what I claim to be the essence or philosophy of the case.

Molders, so far as I have observed, have not studied this subject to the bottom, have not reached the essential idea, or they would not have made such mistakes as are seen in all departments of iron founding where a special feed is required. These disasters are not confined to heavy casting, but many occur in very light work, as one of the following illustrations will attest.

We find loam molders, an intelligent class certainly, continuing, generation after generation, a grave error in feeding very important castings by continuing the mold of a cylindrical casting a foot or more above the casting proper, which will not feed a casting sound, unless very heavy, costing too much in melting, in 5½ per cent loss in iron, in extra brick wall and pit depth, etc., etc.

The highest perfection can be attained without any of these unnecessary costs.

We find, in the green sand department, several feeders on a fly wheel, two or more on a shaft, etc., all of which must be classed among the important errors of the craft, which will not bear the test of either reason or experience.

All that can be said in favor of such practice is that it does not ruin all the castings that it is applied to, though strongly tending in that direction.

The important object in the feeding question is the continuing of the process long enough to make a sound casting.

The first question arising is, how is long feeding best accomplished? The answer is clearly by the most rapid feeding.

A six-inch feeding head would take iron for a year, or a lifetime, if the "settling away" would continue at a certain speed, as any molder can testify. With this fact before us, there is no escaping the conclusion that one feeding head is perfection, that one head possesses the highest feeding powers, simply because it settles faster than two or more, and that when we add another we reduce the feeding power one-half; that

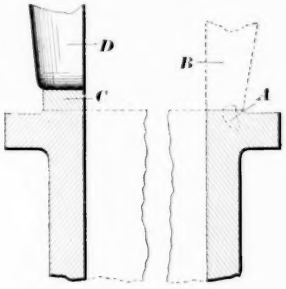


Fig. 1

Fig. 2

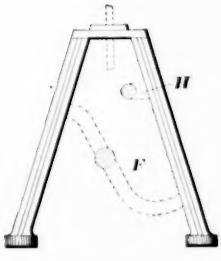


Fig. 3

Fig. 4

when we use four heads we have only one-fourth the feeding capacity of one head, etc.

Apply this principle to large loam cylinders as they are generally fed and we have, for illustration, a row of fifteen or twenty heads, if it were partitioned off, all feeding at once, thus, if human reason is worth anything, reducing the feeding power to one-fifteenth of what it should and might be.

There is no escaping this conclusion, theoretically.

Practice points equally strong to the errors in question.

I had charge of a western foundry in the fifties where the loam work consisted mainly of Louisiana sugar rolls, weighing about three tons, and steamboat cylinders, all fed by the extension, or cut-off rings. I had been condemning that practice as a violation of the true feeding principle, but as we never had any very damaging shrink blemishes—although those castings were never perfect under the cut-off rings—I never went to the trouble of changing the fixtures, but was willing to "let five be even." But finally along came a contract that compelled us to abandon that erroneous practice and adopt the true one.

The job was for a large water works, a 46-inch pump, 100-inch cylinder 12 feet stroke, 4 valve chambers, 76-inch diameter, and many pipes 51 inches in diameter, all ranging from 2½ to 4¼ inches in thickness and from 9 to 20 tons in weight. The first loam casting made was a valve chamber 4¼ inches thick, weighing over 12 tons; in the confusion of getting up fixtures for such a large job no thought was given to the feeding error in question, and it was a little surprise, when the cut-off ring dropped off, to find a dozen rat holes in the joint face shown at A, Fig. 1. The cut-off ring B held about 3,500 pounds of iron, but was a magnificent failure; the casting was accepted for the top chamber, but if it had been intended for the bottom of the pump it would have been condemned.

The cut-off ring C, the height of one brick, was adopted to receive the dross, and the feed gate D, equal to only 9 inches square, set on top fed the 600 tons of loam work in that contract, not leaving a blemish that would receive a pencil point.

The main interest in this case is sound castings, but saving resulted accidentally through a shorter outside wall, less pitting and digging, and a very large amount of iron melting, aggregating a large sum in that 600 tons of loam work.

Away back in the fifties I saw a shaft casting in the street in Cincinnati that illustrates our point nicely. It was a plain, square shaft about 12 inches by 15 feet long. The molder was so anxious to get a solid feed that he had adopted the extended area delusion, the same theory that ruined the valve chamber, Fig. 1, by placing 6 feeding heads on the top, a very bad arrangement in every interest, see Fig. 2. The dressed surface had a diameter of 5 or 6 inches, which indicates a 9 or 10 inch head was used. The molder probably reasoned that, using so many heads, they need not be large, exactly contrary to the true reasoning.

They each had little to do, got lazy and didn't half do that.

The result was what reason, under a correct theory, plainly suggests, a great hole under every feeder.

I claim that one feeder on the end would give a perfectly solid feed, simply because the rapidity of settling in the feeder would be increased six to one, and the time of fluidity in the feeder proportionately lengthened.

The sketch, Fig. 2, presents a top view, showing its true inwardness, its six black holes, its 162 inches of bright, chipped surface, minus the maximum holes.

It would be interesting to know the cost of those two sledge and chisel artists' work when that job was completed.

One end feeder, properly shaped, would break off straight and not cost a cent for dressing; nothing easier, done it many times.

The importance of thoroughly understanding the subject of feeding is not confined to heavy casting.

Disasters of that kind often occur in very light castings, and, being unexpected, are often called blow holes, close examination finding the cavity completely surrounded by a shell, almost infallible proof of a shrink.

Fig. 3 presents a rough sketch of a pump guide stand that may be classed light, and can a tale unfold.

They stood about two feet high, the metal in the standards ⅜ inch thick, in the form of a cross for stiffness, shown in dotted lines, Fig. 4. An old molder cast six of them at one heat, and every one of the twelve lugs was a thin shell shown at E, Fig. 4.

The molder called them blow holes, said he thought he knew how to ram sand, etc., but they were unmistakably shrink holes.

His long, thin sprue at F was entirely insufficient to feed those lugs, they being fully one inch thick.

He was told to shift his pouring gate close to the pattern, making one short sprue, shown at H, which gave an ample feed for those lugs.

Advance Notes of the Latest Hornswoggler Discovery in the Metallurgical World.

By A. HORNSWOGGLER.

Just as I was about to embark for Liverpool for the purpose of closing a deal whereby I would dispose of the right to manufacture and use the Hornswoggler Cupola in Great Britain, in exchange for £100,000, something caused me to change my mind. Just as I was within ten days of being elected to membership in the Royal Fellows and the chance to put my feet under the same table with the Prince of Wales and Richard Croker, something told me that the Hornswoggler principles of cupola construction were being infringed upon. That something was the following article appearing in a Canadian paper:

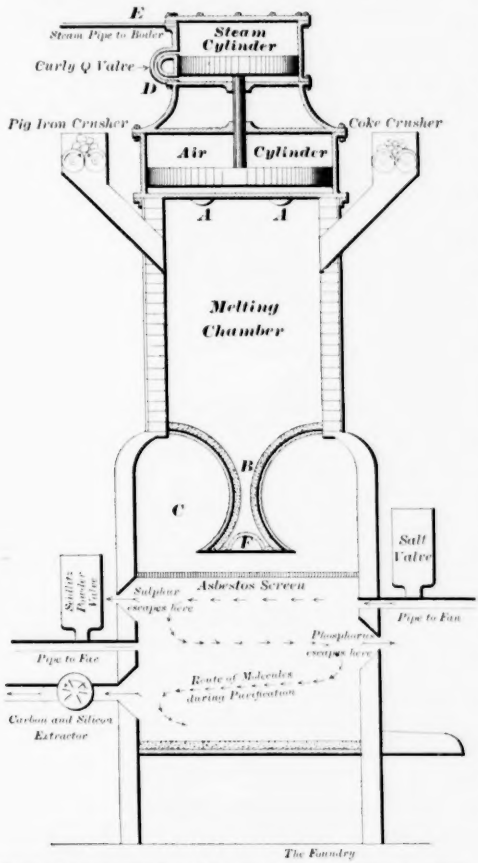
MR. DAMROTY'S LATEST INVENTION.

Cast Iron, by an Air Blast, Transformed Directly Into Steel.

On Saturday afternoon last a number of our citizens collected at the Damroty Stove Works to witness a test of Mr. Damroty's latest improvement in iron casting—the transforming of cast iron directly into steel by an air blast, passed through the melted metal as it emerges from the cupola. For some time Mr. Damroty has been at work on a new method for decarbonizing iron in the process of casting and bringing the resultant metal to a higher grade of steel than was obtainable by his original process. The basis of the latter was the introduction of a steam jet to the cupola. The new process is based upon the use of compressed air. A specially designed cupola also forms part of the new process. The metal, as melted, drops in a small stream through the bottom of the receptacle to a receiver below, and as it falls through a powerful blast of air is directed against it, which blows out the impurities, which find escape through an opening in the back of the cupola. The effect of the introduction of air under pressure is marvelous. The carbon, sulphur and silicon in the iron can be eliminated to any extent desired by the foundryman by regulating the pressure, with the result of producing a steel casting suitable for the class of work for which it is required. On Saturday the blast was regulated for stove plate casting, and did not show the highest results obtainable, but it clearly demonstrated the superior character of the process over that of the original patent. Metal produced under the air blast process shows all the characteristics of steel under the hammer, the drill or the lathe, and there appears to be no doubt that Mr. Damroty has solved the problem of producing steel from ordinary pig iron at a single process, at once simple and cheap. Mr. Damroty's new process astonished and delighted workers in iron, and he was heartily congratulated by all present upon the success he had achieved. The value and importance of the improvement will still further increase Mr. Damroty's fame as one of the greatest metal workers of the day.

Since I divulged the secrets of successful cupola practice by illustrating the Hornswoggler Cupola System in the January FOUNDRY, several unscrupulous persons have attempted to work the thing without my instructions, which cannot be done. I had an invitation extended to me to visit a certain town in Ohio for the purpose of demonstrating the practicability of the Hornswoggler Cupola, but refrained from accepting the same, because the people in that part of the country have the unpleasant habit of introducing unsuccessful experimenters to the coroner while in a suspended state. To tell the truth, good results can be obtained with the Hornswoggler System only when the foundrymen paying for the experiments are in thorough sympathy with the Hornswoggler movements. It requires faith on the part of the foundryman to keep the Hornswoggler System in operation. With an ordinary medium-sized faith, having the dimensions of a Michigan potato, one can melt all the way from ten to twenty-five pounds of iron with one pound of fuel and the iron will appear soft and stronger than common iron. With a fully developed faith, 1 to 40 has been melted and the metal has, to all appearances, been hot and equal to wrought iron. I have mentioned this to show the reason why I did not operate on the citizens of Ohio, whose will power is too self-assertive, and consequently make poor subjects to operate upon, as their subjective minds are out of gear. To a certain extent a prophet is not respected in his own country, and Mr. Hornswoggler has been no exception to that rule. It is my purpose to do the British Isles and the continent before I do those who are willing to be dooed at home.

To the attentive reader there must appear a striking similarity between Mr. Damroty's latest discovery, as described in the Canadian paper, and the Hornswoggler System, as illustrated in the January FOUNDRY. I do not want to underestimate the work of a competitor, and for one I will say that Mr. Damroty is entitled to great credit for having "discovered that the effect of the introduction of air under pressure is marvelous."



THE HORNSWOGGLER CUPOLA SYSTEM FOR OBTAINING STEEL DIRECT FROM CUPOLA.

Mr. Damroty's greatness lays in discovering that it is "marvelous." To be sure, we have introduced air into the cupola under pressure for several years, but it remained for Mr. Damroty to discover that this was "marvelous," and hence he should be given credit therefor. The iron, as it has been melted since the present Mr. Hornswoggler can remember, has also been allowed to fall through a blast of air, but it remained for Mr. Damroty to "discover" that by punching a hole in the rear of the cupola the blast would blow the sulphur in the iron out through the opening. This is certainly one of the most important discoveries in scientific founding and I believe that next to Sir Henry Bessemer, and myself, Mr. Damroty ranks as the greatest living metallo-geologist.

Let anyone who doubts the revolutionary usurpations which must follow consider that Mr. Damroty, as reported, cast steel stove plate castings. How long will it be before we cast our steel ranges? Not any longer than it will take Mr. Damroty to make out licenses to use his method and collect royalties. I can readily see how such a supernatural exposition of occult power could astonish and delight the iron workers on Canada's shores, and congratulations. Shucks! Are our Yankee self-constituted expert metallurgists so overloaded with jealousy that they failed to swamp the Western Union offices with messages of condolence? It will do them no good if they are built that way. Like expansion and contraction the power generated in such a master mind is irresistible.

It is far from my intention of claiming any of the credit which properly belongs to Mr. Damroty, but while I am compelled to admit that his ideas of converting iron into steel are correct and got into print ahead of mine, I am positive his deductions are wrong. For years I have spent my spare moments, when not splitting wood, in perfecting an apparatus to obtain the same object as Mr. Damroty, consequently it is with some sort of authority that I discuss my competitor's cupola system, which in several details infringes upon the one known under the name of the Hornswoggler. I had intended to produce a photographic illustration of my apparatus in operation, but the cloudy weather at this time of the year prevents me. Consequently I reproduce a copy of the working drawings, which illustrates the interior in a way a photograph could not do, and the movement of the metal, from the time it enters the cupola as ordinary pig iron until it emerges as razor steel, can be readily traced without tiring the eyes.

The Hornswoggler cupola for converting iron into steel is built on the principle that there are always somebody waiting to be fooled. With this foundation there is no reason to doubt but that the whole system will be successful, financially. In order that the reader may act as an intelligent jury-

man and judge of the superior construction of the Hornswoggler system I will compare the odious features of the Damroty system jointly with a description of the good points of my own.

From the meager description of the exterior arrangement of Mr. Damroty's cupola I have not been able to form an exact opinion of the length of Mr. Damroty's cupola legs, but I am satisfied that they cannot be much shorter than those supporting my system. Nothing is said about how Mr. Damroty introduces the oxygen to the fuel, but I take it for granted that he employs the old wasteful method of using a fan or blower, minus a steam jet, and that more than half of his heat units go out through the top of the stack to heat the atmosphere in his neighbors' apple orchards. The Hornswoggler system embraces an improved method for maintaining a constant pressure. As will be seen, a steam cylinder is mounted on the top of the stack, on the principle of a vertical pump. Through the automatic valves, A A, air is admitted to the cupola, which is airtight, all cracks being stopped up with mud, the only outlet being at the neck B, through which the metal enters the regenerative mechanism C. There is nothing special about the steam or air cylinder, except the Curly Q valve D, of which some explanation may be necessary, as it forms a new factor in elevated engineering. A certain amount of steam is admitted at E, the expansive power of which propels the piston downwards and air into the cupola. Reaching the point of cut-off, the Curly Q valve opens and admits the steam from the upper side of the piston to its lower side and elevates the piston upwards. This makes a new combination of getting something for nothing, and balances so nicely with theoretical perfectness that nothing is to be desired.

No exhaust is shown on this apparatus, as none are used, the steam being retained in the cylinder until it is used up and disappears in the form of spiritual energy.

While pig iron and coke are used by the Hornswoggler system as a base for producing razor steel, the method of introducing these into the cupola differs radically from that pursued by ordinary humanity. As shown in the illustration, the pig iron and coke are ground by the Hungarian roller process and admitted to the cupola from opposite sides, thus insuring an even charging of the cupola, something which cannot be obtained by any other system of charging. Foundrymen who have had experience at farming know that there is great gain by running a haystack through a feed cutter, and many foundries make a practice of breaking their pig iron in as short pieces as possible. The Hornswoggler pig iron grinder, by thoroughly masticating the iron, saves more than nine-tenths of the fuel ordinarily consumed.

It should be noticed that the Hornswoggler cupola has been greatly improved since January, when the air kept up an endless travel until consumed, which caused the loss of several heat units through radiation of the blast pipes, whereas in the present construction the air is forced into the cupola and compelled to stay there until consumed, without any material loss from radiation, as the brick walls of the cupola are slow conductors of heat. In eliminating sulphur, silicon and carbon Mr. Damroty merely directs the blast of air against the falling stream of metal, which in a cupola melting six tons per hour will descend at the rate of 200 pounds per minute. It must be evident to Mr. Damroty himself that his arrangements for fanning the impurities out of the iron are vastly imperfect. It is plain that, even if the iron descends drop by drop, the blast can only strike one half of the surface, just like the earth only being covered one-half by an eclipse. To obviate this defect the Hornswoggler system employs a ball nozzle F at the entrance to the regenerative chamber. The action of this nozzle is to evenly distribute the metal over the asbestos screen G, which divides the metal into molecules and in this condition allows it to enter the lower chamber to be acted upon by different elements.

The superiority of the Hornswoggler system over all competitors will be evident when one becomes familiar with the painstaking care with which all arrangements have been made so as to produce nothing but the highest grade of razor steel. Mr. Damroty has evidently never reached the higher latitudes in scientific founding or he would have known that the same kind of air will not remove sulphur, silicon and carbon. Air will remove these substances only when it contains some substance for which these elements have an affinity. Thus, salt has a great affinity for sulphur,

and the first strata in the regenerative chamber consist of air surcharged with salt, the sulphur escaping on the opposite side from where the salt enters, and by attaching a short pipe connection to a sausage machine the sulphur may be stuffed into capsules and delivered to drug stores for spring medicine. This is one of the by-products of founding from which considerable is expected.

The thoroughness with which the Hornswoggler system has been worked out may be known when it is stated that the tuyeres conveying the elements to the regenerative chamber are constructed on the principle of an elephant's trunk and impart to the molecules that peculiar corkscrew-like movement so well exemplified in the parabolic curves of the tail of a Poland China hog. Such a twist is true to nature in construction, as well as noiseless in operation, and is quoted here to show one reason for the popularity accorded the Hornswoggler system.

Continuing, the air in the second chamber is surcharged with seidlitz powder, which has a strong affinity for phosphorus, this being readily convertible into matches. When the metal reaches the third or lowest strata an exhaust fan attracts the carbon from the finely divided molecules and allows them to fall to the bottom of the chamber in the form of pure iron, which may be tapped out in the ordinary manner, or a pair of rolls may be deposited right under the spout and rails produced right from the cupola. From the foregoing it is plain that the Hornswoggler system offers the only safe medium for supplying what people want and cannot get. In economy of fuel and general efficiency it distances all competitors.

One cheerful feature of the Hornswoggler system is that iron produced by it is entirely demagnetized and relieved of internal strains. This is accomplished by always erecting the Hornswoggler cupola so that the spout points to the north, when the flow of metal will be in the direction of the pole. By thinking a week or two the reader can readily see that the metal thus cast is not subject to the oscillations of the earth, and is consequently more homogeneous than if allowed to follow its natural inclination. The Hornswoggler system is the only one which proceeds on the scientific principle, that if you give a man rope enough he will hang himself. Of course, in every radical departure from established principles there is something which cannot be explained by ordinary means, but the reader who fails to entirely digest the methods here set forth should remember that this is due to a lack of development of his appreciative organs and not to any fault of the system, which is without a parallel.

In a paper prepared for the Foundrymen's Association Mr. Damroty says: I am quite ready to admit that my knowledge of the sciences is very remote; that after nearly a lifetime spent in the study of iron I know little or nothing, and can only repeat the words of the great Newton: "I am only a little boy playing on the sea shore of knowledge, diverting myself now and then by finding a smoother pebble or prettier shell than ordinary, while the great ocean of truth lies spread out before me."

If the geological formation of the earth in the Damroty neighborhood precludes the possibility of Mr. Damroty finding a smoother pebble than his last system, "his lack of knowledge of the sciences" should cause him to move into the Hornswoggler neighborhood. He will find a lot of rocks there.

Some Suggestions for Producing Straight Castings.

By J. W. DU BOIS.

It has always appeared to me as if the methods employed to obtain straight castings forms one of the most interesting subjects of foundry practice. Take, for instance, a shop doing a large business in architectural work, where there are elevator fronts, having long, narrow pilasters with deep flanges on one side and no flange on the other, and the chances are that somebody will be scratching their heads before they find a way of obtaining straight castings.

Of course, if the castings are not straight, the defect may to a certain extent be remedied by the casting straightener, or the blacksmith, but it is obvious that this entails an increased amount of labor over that on which the cost of the casting has been calculated and forms an unforeseen expense to the cost of the product, which has already been estimated at nothing but a reasonable profit. Nor is the mere question of diminished profits the only question affected. A crooked casting can never be brought back to the true lines, which denote the perfect

casting. Let us imagine such a doctored casting being sent to a building, where it may be examined by an architect, who has partly made up his mind to give your shop a chance to make his work. Will he give it to you if the lines of your castings remind him of the wine supper he had the night before. I am afraid not, unless your figures are much lower than your competitors, and if such is the case, you cannot afford to keep a man straightening castings, as this will only bring their cost higher than calculated upon.

I do not mean to say that every casting can be kept straight, no matter how thoroughly a man understands his business, for there are castings in housework which for a time baffle the skill of the most experienced. But a great deal can be done to better the situation by looking into the causes of these occurrences.

It will be observed that castings for architectural purposes rarely present an equal thickness throughout and herein lays the root of crookedness, and the aim of the molder should be directed towards equalizing the shrinkage in all parts of the casting.

The light side of a casting will shrink more than a heavier one and by gating the casting on the light side, as shown in Fig. 1, the shrinkage is diminished below what it would be if gated on the opposite side.

Let us say that the plate used for the illustration is 3-8 of an inch thick, with an extra

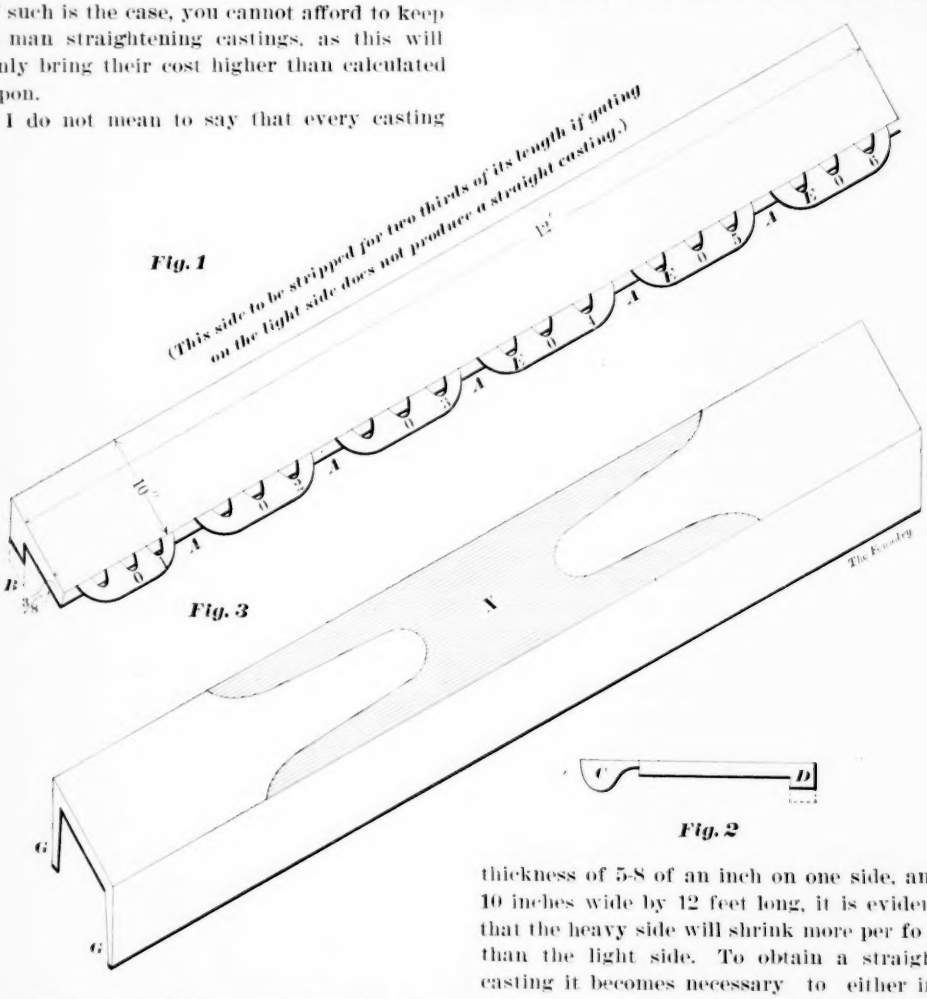


Fig. 1

Fig. 3

Fig. 2

thickness of 5-8 of an inch on one side, and 10 inches wide by 12 feet long, it is evident that the heavy side will shrink more per foot than the light side. To obtain a straight casting it becomes necessary to either increase the shrinkage on the light side or to lower the shrinkage on the heavy side. By gating the casting, as shown in Fig. 1, a greater amount of heat is retained for a longer time by the light side than if the casting was gated elsewhere. In other words, by this method of gating the light side is cooled slower and the shrinkage thereby equalized.

This may look very simple, but it has puzzled more than one molder who did not stop

to think for himself. Even the mere fact of gating a casting of this kind on the lightest side will not insure it coming out straight unless this is done right. I have known such castings to come out crooked simply because the molder did not loosen his end gates 1, 2, 5 and 6, which, when wedged in tight between the bars of the flask, prevented contraction. Should there be an extra thickness on one side, as shown by dotted lines at B, the gates should be connected at the spaces A, which will help hold the light side, providing the gates are cut right.

To secure the best results the gates on the light side should be cut so as to have almost the same proportion as the heavy side. Thus the gate C, Fig. 2, should have about the same cross section as the heavy part D, though it should be remembered, that with equal thickness, there is a greater heat in the gate, owing to the introduction of the metal at this point. In this way the heat from C tends to produce a slower rate of cooling and consequently the main gate, or heater E, as it is sometimes termed, too light, or you will experience no benefit from gating such castings on the light side. The effectiveness of this method consists in having a large gate, which will retain the heat in the light portion, and thus counteract the effect of a similar influence caused by the heavy part on the other side of the casting.

Should the design of such a casting make the amount of metal on the heavy side so great as to prevent its influence being counteracted by a heavy gate on the light side, the casting should be stripped for two-thirds of its length on the heavy side, indicated in Fig. 1, to accelerate cooling and thereby hasten contraction. The heavy gates on the light side should, of course, be retained. Do not strip a casting, such as shown in Fig. 1, on top, for the reason that the extra amount of metal is under the plate, which has a tendency to draw from the bottom and thus raise the center. It is also advisable on this kind of a casting to pour the hottest metal in the center gates, as this will have a tendency to cause the casting to draw from the center instead of from the ends, and help keep the casting straight.

In making a casting like Fig. 2 the pattern should be about 3-8 of an inch high in the center, after the drag has been rolled over, if the casting is 10 feet long. With a five-foot casting the center should be raised about 1-8 of an inch. Such castings should be gated on the ends and receive the hottest metal at that point, to help hold the ends down. Someone may ask how I know the ends will come up. Because at A the casting is thin and consequently the metal will chill very rapidly and begin to contract while the top plate is yet in a fluid state. To prevent the casting from drawing, the top part of the casting should be stripped as shown by the shaded portion X. This will keep the casting straight, provided it is done quickly enough, so as to lower the temperature in the top part as rapidly as in the bottom flanges. If a molder loiters around after pouring he will find it useless to strip the casting, for the reason that it is already out of shape and cannot be brought back.

Molders working on this class of work should form the habit of inspecting their patterns and note where heavy portions are located. In this way they would form some idea themselves as to what ought to be done to keep a casting straight. Many molders rely on the foreman altogether for information of this character, and while his advice should always be welcome, and while it is his business to furnish suggestions, still as a general rule the molders would know more and be worth more if they would solve some of these questions on their own account.

Take Your Choice.

Indications are multiplying that progress in the manufacture of pig iron and in the production of castings will bring the founder and furnaceman closer together and will prove very beneficial to both. The multiplication of foundrymen's associations in this country during the past few years and their activity has done much to stimulate a desire for improvement. Although some of the papers read have been elementary and a part of the discussions have been crude, wide publicity has been given in the technical press to the transactions of these societies because of their important educational influence. It is not too much to say that many of the quaint conceits prevalent among foundrymen have been swept out of existence, and that there is now a wider and a better knowledge of facts and a greater and more intelligent eagerness to progress than there has been. Some of the old prejudices linger with characteristic persistence and there is some justification for it, because enthusiasts have often claimed too much for modern methods.

It is probably not too much to say that progress must naturally come from the founder, because the pig iron producer stands to the former in the attitude of the seller to the buyer, whose requirements he must meet, and even whose whims he must cater to. Under such conditions the furnaceman must be circumspect. Yet it is easy to discern in what direction progress is tending.

One of the most serious embarrassments to the use of chemical analysis as a guide to the founder is the fact that only too often the analysis itself does not really represent a fair average of a lot of iron because the sample is not correctly drawn. Furnacemen know perfectly well that there is a very large variation in the composition of the pigs produced in one cast from the furnace and that it is very difficult to get a true sample. Lately the tendency is developing among furnace managers to interpose a ladle between the furnace and the cast house. In other words, the iron is not tapped direct from the furnace into the casting bed, but is first run into a ladle, from which it goes either to a casting machine or to the pig beds. This means, in either case, that the iron in one cast is thoroughly mixed and that there are not the variations in the individual pigs which are now so common.

It is pretty generally understood now that the grain of a pig iron is determined not alone by chemical composition, but that the rate of cooling has an important bearing, often modifying and sometimes completely overriding the effect of chemical composition. We believe that once the uncertainties as to the chemical contents of pig iron in a cast are removed grading by fracture will receive its death blow, and then the expensive method of casting into pig beds and handling in the cast house will rapidly disappear.

Quite a number of foundrymen still hold to the conviction that there is some mysterious effect for good in the sand which adheres to the pig iron cast in the bed. They look askance at the iron cast in a casting machine, which has conquered its position in the favor of the steel maker. On what ground sand adhering to pig iron can possibly be anything but harmful in the cupola it is difficult to understand.

We believe that it will not be long before the old fashioned cast house will be a relic of the past, and that then foundrymen will charge clean iron, with a guaranteed analysis, cast in casting machines from a ladle into which the iron has been run either from the furnace or from large mixers which are capable of taking care of more than one cast.—Editorial Iron Age, Feb. 10.

Is the last iron drawn from a cupola harder or softer than the first iron of the same heat? This is a question discussed by Mr. E. W. Smith in a paper of which we give an abstract in another column. His answer is that it may be either harder or softer, according to conditions, and he gives eight different causes of a mechanical nature, relating to the method of charging, of blowing, of drying the cupola, of varying the distribution of the fuel between the bed and the upper parts of the charge, of drawing off the slag, etc., which may change the conditions of melting and tend to make the iron either softer or harder.

Many of the changes of condition discussed by Mr. Smith seem to be unavoidable incidents of cupola melting. While much may be done, in the way of careful superintendence, to render uniform the conditions of melting, and to increase the chances of obtaining a uniform product, still it seems to us that the cupola must always be considered as an imperfect and unscientific instrument for melting cast iron, something which must be endured, so long as it is the cheapest instrument available, but which must ultimately give way to better appliances.

The "air-furnace," or reverberatory furnace, has long been used instead of the cupola, for melting cast iron for purposes in which the highest strength and uniformity are more important than cost of melting, such as the manufacture of cast iron guns, chilled rolls, etc.; but the cost of installation and operation of such a furnace has been too great to permit its general use. There is, however, another method of obtaining melted cast iron of uniform quality, and of any desired quality, which is as good as the air furnace, and cheaper than the cupola, its only objection being the cost of installation. It is the method which is used in the most modern Bessemer steel works for obtaining melted iron for the converter. It consists in taking the iron directly from the blast furnace into a ladle, dumping it into an im-

mense "mixer" holding 100 tons or more, from which, when thoroughly mixed and of uniform quality, it is taken by ladles to the converters to be made into steel. The same method is used in the foundries attached to the steel works in which the great ingot molds for casting the steel are made. Iron is taken from the mixer into the foundry, and the cupola is dispensed with. Some day some blast furnace company will build a great iron foundry alongside of its furnaces with mixers between the furnaces and the foundry, in which the metal can be chemically treated to desiliconize it or to add manganese. Gas-heated ladles will be used, in which small batches of the liquid metal may be treated for special purposes, and either hard or soft castings, or castings of any required degree of strength may be obtained, with a degree of uniformity which is not possible with the cupola process. When that day comes, there will be a revolution in the foundry business as complete as that which during the past ten years has overtaken the owners of the small old-style blast furnaces.—Editorial Engineering News Feb. 24.

Two lines of work have always fascinated experimenters in iron: Obtaining iron or steel direct from the ore, and making castings of all kinds with melted metal from the blast furnace. In both directions success has been attained to a degree, but in neither case has sufficient progress been made, nor were enough favorable conditions observed to warrant extended investment.

The paper discussed at the last meeting of the Western Foundrymen's Association, on the changes occurring during cupola melting gave occasion for an interesting editorial in last week's issue of Engineering News. The prediction is made that some day a blast furnace company will build a great foundry alongside of its furnaces, with mixers of 100 tons or more between, in which the metal can be chemically treated to desiliconize it, or to add manganese. Gas heated ladles are suggested, for treating small batches of the liquid metal for special purposes; and it is affirmed that hard or soft castings of any desired strength would be produced with a degree of uniformity not attainable in the cupola. When this day comes, it is rightly predicted, there will be a complete revolution in the foundry business. Will this day come? The question is one of some importance to foundrymen.

Castings have been made from the blast furnace direct, for many years, but of a kind which did not require the use of soft irons. They were not high in silicon, were heavy, required little or no machining, and there is no evidence that they were as strong as other castings of the same composition but made from remelted pig iron. The presumption is the other way, since investigators who have applied microscopy to the examination of pig iron say that mechanically mixed slag is usually present. It is a question if the holding of melted iron in 100 ton mixers would allow this slag to rise. Will the "kish" problem, recently discussed in our foundrymen's associations, be taken care of in the richer grades of foundry iron? Will the physical effect of closing up the structure of the iron, outside of that produced by chemical changes, be obtained, equal to that now effected by the addition of stated proportions of scrap and remelting? It does not seem likely; and this alone would be a fatal objection. A bath of melted iron, say of 100 tons, held in mixers until thoroughly uniform—aside from the difficulty of finding out which it is in time for use—would behave, it has been suggested, somewhat like a "heat" in an open-hearth furnace just ready to tap. Metallurgists refer to the constant refining action going on in such a case—silicon and manganese being oxidized and slag forming constantly, so that the end of that 100 tons would be very different from the beginning, unless poured very quickly. There is the advantage that the metal is contaminated less with sulphur than is cupola iron, but when soft irons are made for the regular run of foundry work, it is doubtful if sound, strong castings could be obtained. When hard irons must be had for chilled work, the holding of 100 tons of this material would be a rather dangerous operation for the operators, if overheated; and equally so to the mixing furnace if too cold.

Only for that class of castings which in composition correspond to Bessemer iron, and in the interior of which the presence of mechanically mixed slag would do no harm as long as the surface was good, could the idea of a large mixer be carried out with some show of success. Ingot molds are of this class; but how car wheels or the frames

of huge dynamos would fare, or jobbing work, and castings of a small size but in great quantity, is another question.

The cupola is by no means a scientific instrument for melting iron. Anyone who sees the flames belching forth from the stack quickly realizes this. Still the cupola is not as bad as usually represented, for such castings as air brake cylinders can be made day in and day out with great uniformity and perfect satisfaction. The cupola, too, makes it possible to produce various grades of work within short intervals of time. And accepting the common testimony as to the changes effected in melting the same mixtures in the various stages of a cupola heat, good management will turn them to the best account by a proper sequence in the pouring off of the molds.

The immense blast furnaces of to-day have probably reached the limit of size; immense converting and open-hearth plants alone can take care of their daily product. Furnaces making iron suitable for castings may well be kept within limits as to capacity; and if instead of adding a 100-ton mixer to a furnace a 5- or 10-ton mixing ladle be added to the cupola, a uniformity will be obtained much better for the purpose than ever could be with the plan suggested.

The idea of using gas-heated ladles and treating small batches of iron chemically looks well enough, but might be very difficult to carry out successfully, not to speak of the cost of such operations. There is a lack of uniformity in the resulting mixture, the temperature necessary for perfect fluidity will be changed, and thus fluctuation, if upward, cannot be taken care of by the external heating quickly enough to allow a holding of the metal until the slag formed by the oxidation has risen. Again, manganese will never be added, as suggested, so far as our present knowledge goes; if anything, there will be too much present in the first place.

On the whole, if the editorial in question will deter intending investors from further overdoing the foundry business some good will result; but there need be no immediate fear of a revolution in foundry matters. In fact, the efforts of large corporations, in equipping foundries to make their own appliances, while sometimes cheapening them, have seldom been productive of as good results as obtained by founders of specialties. —Editorial Iron Trade Review, March 3d.

Annealing Malleable Castings.*

By ALEXANDER CAIRNS.

Castings to be annealed are cleaned in the tumbler, pickled, sand blasted, or not cleaned at all, depending on the shop practice. Small castings, such as saddlery and carriage hardware, agricultural and similar classes of work, are annealed in a satisfactory manner with the sand on them. Large castings are milled or cleaned in the tumblers as a rule, although if packed without cleaning will require reannealing.

The furnaces used to anneal are rectangular in section, about 10 feet wide and 18 feet long and 8 feet high in the center of the arch. The fire place is set on the inside in one corner of the oven, and usually the grate surface is 2 feet 6 inches by 6 feet, extending upward to within 8 inches of the roof of the furnace. The flues extend along each side, on a level with the floor, and should be about 4½x9 inches, so that a stock fire brick will just fit them. It often happens that a furnace which is one of a number entering the same stack will not work according to calculations, in which case the flues are stopped up or left open until the furnace has been found to work right. Various forms of doors are used for these furnaces, that in which the brick are set into a permanent sling being the most prevalent.

Malleable cast iron castings are annealed in rectangular sectioned castings called pots, which are set upon a bottom and built four or five high, making one continuous pot from the bottom up. According to the character of the work the continuous pots are divided by setting plates between each of the sections so as to keep the castings separate. They vary in size from 12 inches wide, 24 inches long, 18 inches deep and ½ inch thick for light castings to 30 inches wide, 72 inches long, 18 inches deep and 1½ inches thick for the longer classes of jobbing and railroad castings. At times it is advisable to make special sections in round, square and triangular shapes, when the order on the particular casting will warrant the expense. Such castings for which there are no pots, and for which it is not advisable to make them, are bricked up in the furnace with fire brick and firmly bedded in and covered with packing. The bottom

*Paper read at the March meeting of the Philadelphia Foundrymen's Association.

plates are made the same size as the pots and from 2 to 3 inches thick and sufficiently high to admit of easy handling with the truck. The pot sections are molded in green sand, cast from the cupola, do not become annealed in use, and will last from 15 to 18 heats. In order to secure the best service from them it is necessary that a fairly good quality of iron be used.

Packing is a shop term applied to the class of materials used to pack the castings so that they will retain their shape when hot. It is also applied to the materials which answer the above purpose and in addition supply oxygen or have the latter in their composition. A number of different materials are used for the former purpose, which are used principally on light castings. Almost anything that will stand up well while hot is suitable, like ground burned fire brick, iron borings and sand. As they of themselves do not supply oxygen, it is necessary in using them that oxygen be obtained by means of a coating of rust or oxide upon the castings either before or after charging the pots. In rusting them before much of the oxide becomes rubbed off in packing. Packing the castings wet would do, provided there was some certainty of their being oxidized before heating. Wetting the packing with dilute ammonia is a very sure means, and in the absence of anything better than ammonia is the most satisfactory way of handling this material.

The use of this class of packing has evidently been confounded by Mr. Davis in a former paper with the process described by Forquignon, with which it has no relation, but is rather the Reaumur process, with the source of oxygen formed on the castings by oxidizing them instead of the packing furnishing the oxygen. Of the latter class of packing, forge scale and hematite ore are used. I am familiar with the former only. It is an iron oxide and becomes more desirable as a packing the longer it is used, for the reason of its finer division and consequently laying closer to the casting. In using this packing on castings cleaned or those having the sand upon them no effort toward forming an oxide upon the casting is necessary, although the formation of such oxide saves the packing; that is to say, less of the oxygen in the packing is consumed. New or green packing is worked in gradually on the heavier work.

Packing or charging castings in the pots, so that they retain their shape and do not scale or hang while hot, is a process that cannot be well described. In general they should be packed with a view to keeping the packing in close contact with the castings during the settling of the contents of the pot. For instance, flat plates or sections should be packed on edge; if on the side they will scale on the bottom, from which the packings has settled. This explains why some castings scale and others do not in the same pot. Castings having projections or unequal sides, which can therefore be stacked on top of each other, are built up from the bottom plate with a view to balancing the pile. All long sections and all castings, unless packed in pots that will admit of their being placed horizontally, should be set upon the bottom plate vertically. I have seen castings 5 feet long become ¾-inch longer than the pattern because they were packed some inches above the bottom plate and hung in the pot during settling. As a general rule there is a relation between the amount of the packing and the castings, or between the oxygen in the packing and the carbon in the castings; there can therefore be a condition where there is not sufficient packing between the castings to anneal. There should always be an excess in favor of the packing. The packing of the castings is carried upward with a view to meeting the unequal heating of the pots—that is, heavy castings in the top and light ones in the bottom, separated by plates when the occasion requires it. Beginning with the bottom plate, the first pot is usually a new one. They do not take the heat readily, on account of the sand upon them, and for this reason should be broken in on top. Owing to their weight, however, it is not practical to use them there. Building or packing continues upward, the pots being placed according to their age, the top pots passing out of service.

The matter of packing castings is attended with many difficulties which materially add to cost, and which can only be overcome by long experience and observation. The author has been perfecting a method of annealing castings, on which patents are contemplated, without packing them. The method will apply in particular to that class of complicated shapes on which the hand-

ling and labor of packing and straightening constitute an important item.

The pots, some 55 to 65 in all, holding from 20 to 22 tons of castings, are set into the furnace with space about equal to their bulk between them and the walls. Those containing the heavier castings are placed in the center. The furnace is closed up and firing is continued for three days, the door removed and the pots taken out. They may be allowed to stand for some time, depending upon what the labor engaged in handling them may be doing. Under ordinary conditions the first 24 hours' firing shows the pots a red heat, and on the third day they are a bright yellow and can be readily distinguished in the furnace. Firing on the last day stops with the disappearance of carbonic oxide flame. There is no regular length of time for this flame to burn. It depends on the relative proportions of castings to packing or carbon to oxygen. Its disappearance usually is not an indication that thorough annealing has taken place, although it may be, but is rather an evidence that the oxygen in the packing immediately adjacent to the casting has been consumed, spent or used up. If it were possible to raise the pots to the necessary temperature in 12 hours annealing would take place just the same. Experiments that accomplished this, but were made with a view to saving the fuel used in the furnaces, were made some years ago in New York. The pots were set into the flue of the furnace, but as there was no satisfactory way of controlling the temperature at that time annealing by this means was discontinued. Small or medium-sized castings can be annealed in a few hours by packing in a hand ladle, removing a few brick from the side of the furnace and setting in on top of one of the pots with a pair of tongs. Large lots of castings are annealed in from one and one-half to two days by selecting the furnace nearest the stack and enlarging the flue area—that is, taking out a few brick with which some of the flues had been stopped. If the pots are five sections high the top section only is packed, the lower one being empty, having plates set in between them so as to raise the top pots as near the roof of the furnaces as practicable. As soon as annealing is indicated the firing should slack off and the pots be allowed to soak until the flame has disappeared.

The manufacture of malleable castings without annealing has received much attention from practical men in the business, and one direct result of experiment in this line has been the discovery of a mixture 1½% of which renders the castings workable to some extent, but they are in no sense malleable. This class of iron has been used in steel ranges and castings wanted in a hurry.

On the whole the process of annealing is a very simple one, and there are many apparently mysterious happenings that are due to quite simple causes. Owing to the variations in the working of the furnace a heat is occasionally burned in the top pots. This is a matter of firing and is not common in old furnaces that have been experimented with until found to work right, but cannot be avoided entirely in new ones. Heats are often withdrawn and found to be not annealed. This is an evidence that the furnace was not hot enough and that it was not properly watched. Heats of this kind are returned to the furnace and fired over.

Some of the Advantages of the Positive Pressure Blower Over the Fan for Melting Iron.*

By J. A. CALDWELL, M. E.

One of these advantages is that the blast is positive and that it positively and aggressively goes to its appointed work of furnishing one of the principal ingredients for the melting of the charge, independently of the ever changing conditions in the cupola, as against the unreliable character of the blast from the fan, which has nothing positive or certain about its action.

The makers of the positive blower claim that since each pound of fuel burned requires an absolute measure of air for its complete combustion, whether in a cupola or anywhere else, that the means of getting that air to the point or zone of combustion should be as absolutely fixed and certain as mechanism can make it.

The law of combustion is, of course, a law of nature and not the dictum of this or that blower manufacturer. Prof. Thurston, an acknowledged high authority on the subject, states that perfect combustion occurs only when all of the combustible is burned, and

*From a paper read at the February meeting of the New England Foundrymen's Association.

with the result of (or in conjunction with) producing the highest stage of oxidation, which can only be reached by the use of a proper proportion and application of air.

Theoretically perfect combustion is perhaps unattainable in the arts, but the physical laws for producing and maintaining a high rate of combustion or temperature are known, as well as the mechanical steps necessary to attain such conditions.

Cupola practice is really a system of what in other branches of mechanics' arts is termed "Forced draught," and James Howden, the greatest living authority on the subject of forced draught, states that for 12 pounds of coal burned on a square foot of grate per hour, there should be provided 22 pounds of air, or 286 cubic feet for each pound burned, and for 16 pounds per square foot per hour 312 cubic feet, and for 20 pounds 364 cubic feet. Thus we see that the faster the process of combustion is carried on the more air is required per unit of fuel, and we also see the necessity of having the means at hand that will insure the air getting to its destination.

When the proper quantity of air is supplied, each atom of carbon (of which the coke is almost wholly composed) meets its corresponding atom of oxygen, and a high state of combustion ensues. When, however, a sufficient quantity of air fails to reach the cupola, the carbon, being changed into its gaseous state by the surrounding heat without meeting its corresponding atom of oxygen, is carried out unconsumed, thus entailing heavy loss, amounting under certain conditions to as much as two-thirds the total heat power of the fuel.

It can easily be seen why the positive pressure blower is superior in this regard to the fan, delivering and forcing forward as it does a fixed and definite quantity of air at each revolution under all conditions of the cupola, so that commercially perfect combustion results.

If it were a fact that a cupola called for less blast in exact proportion as resistance increased, and more blast when everything was free and open, then the fan would be the ideal machine, furnishing, as it does, such conditions automatically and without external regulation; but when the reverse is exactly the case, and even more air rather than less is demanded when the condition of the stock causes unusual resistance, then the fan fails to supply it, just as fans are at their best when least pressure is required. Like a horse that has a habit of backing the moment his feet touch the foot of a hill to be ascended, and beginning to pull as soon as the wagon struck the descending grade, we would say of such a horse, "It is a pity he did not pull going up hill and do his backing while going down hill." And so we say of the fan. But the fan keeps on year after year doing its best (under strong protest) to meet the conditions forced upon it that it was never meant by the laws of mechanics to fill, and when its honest efforts to raise the wind are opposed it simply beats the air with its wings, much as a tethered eagle would do that tried to soar beyond the reach of his chain. The reason of this is, of course, because the blast from a fan is due to the centrifugal force of the air sliding, so to speak, off the revolving blades, and when that radial and tangential delivery is obstructed by closing the outlet or discharge opening, the fan continues to run as before, carrying the air around with the blades but no blast being discharged, and if the resistance is only partial then the volume of air from the fan diminishes in the same ratio as the resistance, till a point is reached when the momentum of the radially driven air and the resistance are equal and no air whatever is discharged. Of course the wheel or blades continue to revolve with great rapidity and absorb a large amount of power while doing no work at all.

It is not strange that this very glaring fault in a fan's action is constantly being lauded by its makers into the dignity of an estimable virtue. It is called the safety valve action, the automatic relief, and so on, but it partakes of the kind of relief we have all experienced at a church fair. It is a delightfully easy way of getting rid of any objectionable heaps of coal that may be lying around loose, the larger the heaps the better; in fact, it takes from 35 to 40 per cent of the power required to do full work to run the fan blades at the same speed with the discharge opening closed down and of course no work at all being done.

But the explanation offered by the fan advocates that "hardly any power is required," when the fan is running thus is one of those fictions that is a good selling thing and gets pushed along unquestioned for all it is worth until it comes to pass current as gospel truth.

The real fact is that of all faults inherent in the fan, this so-called automatic relief action, which proves so costly a luxury in fuel, is the one of all others its advocates would like best to get rid of, and fame and fortune await the lucky inventor who can at one bound eradicate this fault and thus make the fan into a positive pressure blower that would sell at the same price at which it now sells. As the case stands at present no certainty of action can be predicated on the operations of the fan, as the volume of air is varied by every contingency that arises to vary the resistance within the cupola, and as for emergencies calling for more than the usual pressure, they cannot be met, and we all know that in hundreds of instances the charge has to be dropped. A few weeks ago I was in a foundry when this had happened a number of times, including only the day before.

With the positive pressure blower all this is different, since each revolution, running slow or fast, means a fixed amount of air forced forward, an amount which is not altered whether the resistance becomes greater or less, and in an emergency when more air is needed it is but the turning on of more steam, as often happens in blast furnace practice, and indeed with all mechanico-chemical industries.

In this connection a most valuable point should be noted. That is, the saving in time effected by using a positive blower. It will be at once admitted that if the fuel in the cupola can be properly consumed, a very much greater heat will be generated, preventing dull iron and slow melting. Therefore, with a given size cupola a larger amount of iron can be melted in a given time. This enables the foundryman to turn on his blast at from one-half to an hour later than when using a fan, giving him this extra amount of time for his men to mold, greatly increasing the amount of iron melted. The saving that this point alone makes in the average foundry in a year, goes far towards paying for the cost of the positive blower over the fan.

Again, soft and fluid iron can only be secured by perfect and uniform combustion in all parts of the cupola, rapidly melting the iron and getting it under the slag, where it is protected from the action of the blast, and consequently from being decarbonized. If the combustion is imperfect around the walls of the cupola, then the iron is exposed for a long time, in a mushy, semi-fluid condition, to the action of the blast, and rapidly decarbonized, converting it into steel. Thus a similar process is carried on in the cupola, as in a Bessemer converter. This iron, as it slowly melts and drops down into the melted iron below, makes either hard spots in the castings or deteriorates the whole, as it is more or less mixed with the mass. A further result of this condition of things is that the iron having parted with its carbon, loses its fluidity, and will not run or fill the molds, causing imperfect castings. When these things are properly understood, the importance of having a positive blower will be realized. The blower is the lungs of the foundry. A good blower is fundamental to the highest degree of success, and the small amount saved in the difference in first cost between a positive blower and a fan is dearly paid for in the losses that follow.

A second advantage is that the fan requires to be run at ten to fifty times the speed of the positive pressure blower. It is easy to simply say "ten to fifty times faster," and pass it over without thinking much about it, but any one that has had to do with fast running machines of any sort knows what he has to endure in the way of burnt bearings and broken belts, in fact, the usual enormous wear and tear incident to such machinery under ordinary conditions so commonly met with. In hundreds of cases the exasperation from these experiences alone have resulted in telegraphic orders for positive pressure blowers. The fan might be compared to a horse running a mile in two minutes liable to stumble at a mere straw in the way, while the positive blower might be compared to the good old steady draught horse that can always be relied upon.

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Trade Outlook.

After five years of prophesied resumptions of the country's industries, it is evident that the element of politics has been largely eliminated from the present activity. That the people are again becoming themselves and losing the nervousness in business affairs formerly characterized by numerous shut-downs and re-openings, is shown by the fact that war scares and sensational news in general has not affected either production or consumption to any perceptible extent.

Some of the heavy purchases of pig iron are credited with having been done as much to take advantage of low quotations as to meet current demands, though a casual glance at the general run of foundries makes it clear that more iron is being consumed than has been the case for years. The specialty shops are more or less crowded and even the pipe foundries which have occupied the rear of the procession are showing more activity.

A recent review of the iron market by Rogers, Brown & Co., probably represents actual conditions as well as anything could do. They say: That the actual current business is large and healthy is shown by the demand for shipments on running contracts. It is now quite as common for a buyer to ask to have his shipments made in advance of specified dates, as it has been for some years past to have them postponed. The small increase in stocks during February and the slight increase in rate of production shown March 1st, have no significance. The natural enlargement of business as spring operations come on, will quickly absorb the small additions to stocks, if business keeps on its normal course. It should be noted that while stocks at furnaces are counted liberal, they are nevertheless smaller than they were six months ago and at current rate of consumption would be absorbed in three weeks if all production ceased.

Business Ability and Genius.

Sir Henry Bessemer, who died last month in London, was one of the few inventors who possessed enough business ability to provide himself with a competency. The process which bears his name has been looked upon by many as a piece of luck, and others have claimed priority of discovery, but the several years spent by Mr. Bessemer in the study of metallurgy previous to the announcement of his discovery, would tend to refute the charge that the Bessemer process was the result of a chance experiment. Others working in the same line may have possessed an equal or greater genius than Mr. Bessemer, but none had as great ability to demonstrate by a successful application the worth of their calculations.

A Little Jingoistic.

To be able to see ourselves as others see us is one of the missing virtues of the Anglo-Saxon race. The Englishman a few years ago hooted at the idea of buying iron from this country and the American of to-day will snort if anybody doubts his ability to conquer the markets of the world. As a people we are "set" in our ways and if we once become impressed with an erroneous idea this becomes difficult of eradication.

Our British cousins are evidently becoming "sot" in their opinion of American pig iron and its cost of production, judging from the way the Trade Journals Review handles the subject under the caption of "The Invasion of American Pig Iron." Here is the way it is accounted for:

"We have known for some time that a considerable quantity of American pig iron has been imported into England and sold at prices lower than those required by the British manufacturer; and considering the transport charges and freights the foreign stuff has to bear, the wonder has been how it can be done. The secret of it is out. The iron imported is mainly the product of convict labor. It appears that the American ironmasters are allowed by their government to hire the convicts from the penitentiaries at a very low rate, or at no rate at all in some cases. Hence the wonderful cheapness of American pig iron. Naturally the English makers felt aggrieved, and thought they had a remedy in the new Prison-made Goods Act. But the act has utterly failed to bear the first serious test to which it has been subjected. On the commissioners of customs being appealed to, they replied, after long consultation with legal authority, that "the provisions of the act did not apply to goods made outside a prison by farmed-out convict labor." Could anything be more absurd? Goods made inside a prison cannot be imported, but if the prisoners work outside the walls the goods are all right and eligible. So there is no redress for the British ironmaster, and the traffic in American pig iron goes on increasing."

None regret more than ourselves that some of our people will violate laws and be put in jail, where they must be furnished compulsory employment. In different sections of the country convicts have been instructed in several trades, notably furniture manufacture, shoemaking, and we believe there are several states operating a foundry in connection with their penitentiaries. Now if we should say that the price of castings, furniture or shoes was regulated by the small number of "sinners" engaged in these industries we would undoubtedly lay ourselves open to ridicule. This is what our contemporary does when it accounts for the wonderful cheapness of American iron by the fact that a small percentage thereof is produced with the aid of convict labor. That less than a thousand convicts could possibly regulate the cost of production in an industry employing indirectly hundreds of thousands is too absurd for any serious consideration.

In a congressional debate of about a year ago relating to the cost of producing pig iron, it was shown that the labor cost per ton of iron was five cents more in the southern than in the northern states, where no prison labor is engaged. It is true that the south is filled with what is called "cheap" labor, consisting of a flotsam and jetsam population without much ambition, but this labor is cheap only in name. A dollar's worth of this labor does not go as far as a dollar's worth of more intelligent labor. Our British cousin makes the mistake of judging the cost of pig iron production by the rate of daily wages instead of by the labor cost per ton of output. His opinion in this matter savors strongly of jingoism.

CAST IRON NOTES.

Devoted to Inquiries from Practical Foundrymen on the subject of Melting and using Cast Iron. Address all Inquiries to W. J. KEEP, care of The Foundry.

"PAT. PROCESS."

Enclosed with a pamphlet describing a Process of Iron Founding was the following letter: "Has the 'Pat. Process' referred to in the enclosed circular ever been brought to your notice? If so, what is your opinion of it? In this age of improvement in foundry practise we ought, I presume, to pay attention to every invention that is brought out."

It seems to be generally acknowledged that people like to be humbugged. Showmen make money out of this peculiarity.

Foundrymen often endorse a thing because it is beyond their comprehension.

If blowing air that is highly charged with fog into a cupola increased the speed of melting and improved the quality of iron, there are so many damp days that the difference between melting with dry or damp air would have been noticed long ago.

There is no difference between using the damp air of a misty day and the dampening of the air of a dry day.

I have seen this process tried in two foundries and on those days the added moisture was a disadvantage.

I have arranged to put this into a cupola as soon as I can see a single case where it has proved an advantage.

High sounding language does not add any merit to any foundry operation.

Before this process was made public samples of the castings were brought to me and

I was told that this was the first time that they had been shown in the United States.

I accepted an invitation to go and see the process applied in a cupola and had test bars made, but in that case they did not show any advantage. Soon after, a molder who had seen me in the shop sent word that there was a gain, not from the moisture but from an addition that he and the foreman had added to the ladle. A little later I received a visit from this molder and let him make his addition, but test bars did not show any improvement. In this case a portion of the addition was saved and it proved to be ordinary potash.

A few years ago it was claimed that the addition of white sand along with the charge of pig iron had been patented.

A pamphlet was issued containing elaborate tests of bars made without and with the sand addition.

Before long I received a visit with a proposition that they be allowed to supervise our melting for two days and demonstrate the value of the addition of sand. I asked how we were to know if there was an improvement and was told that it would be so apparent that the iron in the ladle would show it, and that the color of the casting would be darker and the grain more compact. I told them that our cupolas were at their service, but that I should measure the shrinkage and strength of castings made with and without the sand addition, and that it must be understood that we would not pay any royalty even if by any changes in charging they did show an improvement, because we did not consider that a patent for the addition of sand was valid, and furthermore, that we each day added sand with each charge. A law suit was threatened at once, but we told them that we had used the sand addition before they even thought of a patent. On being pressed for a description of our process, they found that the sand was that which adhered to the pigs and to the sprues in the remelt.

I was requested not to mention the interview. But now the process being dead there can be no harm done by telling the story. When I was looking at the cupola with moisture being blown into the tuyeres I was was told that the spray was first applied at the fan and sent through the long wind-pipe with the same beneficial result. The change in location of spray was probably made to permit a patent being granted.

The reason the founders are led away by these "Pat. Processes" is that they do not know how to tell what kind of castings they are already making, or how to remedy the defects that exist.

PURE IRON FOR CASTINGS.

Would not pure iron, if obtainable, make the best castings?

In the first place pure iron cannot be obtained. The purest iron that can be obtained commercially is the ordinary bar iron. This cannot be melted in a cupola, and if melted would not remain fluid long enough to fill a mold, and if it could be got in a mold the casting would be full of blowholes. Pure iron is very soft and very ductile. The nearest approach to castings of pure iron is the steel castings that are quite common. Some addition is made to prevent blowholes. The expense of making steel castings is very great.

To enable iron to be melted in a cupola it must contain at least 2 per cent. of carbon, and such iron will make white and brittle castings with many blowholes.

To obtain grey iron castings it is necessary that they have considerable silicon. Large castings will be grey with less silicon than small castings, because they cool more slowly, and the smaller amount of silicon has longer to exert its influence. To obtain fluid melted iron, and to have it remain fluid long enough to fill an intricate mold, it is necessary to have some phosphorus present. There will not often be enough sulphur in grey iron to exert much influence.

Manganese does not exert much influence in small amounts and an increase simply hardens the casting.

It is, therefore, apparent that these additions are a necessity to good castings.

It is not possible to make pig iron without these additions, and where the purer Bessemer grades are used the results are not as satisfactory.

Gelatine Molding.

Could any of our readers give us a few lines upon gelatine molding, or the system of making articles in iron, brass, bronze, etc., by the use of flexible molds? I have seen some of these cast articles, which, if the molder had to make them in the ordinary manner, would have entailed numberless points, drawbacks, etc., and an enormous amount of time to make, but which are eas-

ily made by the gelatine process.—(One of our English subscribers asks the above question, and as we are unfamiliar with the process referred to, we publish the question for what it is worth, and invite our readers to express their opinions.—Ed.)

CHEMISTRY IN FOUNDRY PRACTICE

We have arranged with Mr. S. S. Knight to answer such questions as relate solely to Chemistry in Foundry Practice. Our readers are invited to send us queries relating thereto.—Ed.

CHEMISTRY IN FOUNDRY PRACTICE.

Question:—What effect does Bessemer iron have on chill? Does or would 10% in a charge of 4,000 pounds; 40% pig and 60% scrap car wheels have any effect tending to reduce hardness of chill?

Answer:—In answer to the above, which seems a very simple question, it will be advantageous to consider the phenomenon of chill. According to popular theory, chilling takes place whenever the combined carbon of liquid iron is deprived of the opportunity of changing to graphite carbon. The usual manner of carrying the process on in practice is to cool or to set the metal before a sufficient time elapses for the chemical decomposition of the iron carbide to take place. It will be seen to readily follow, that anything tending to make iron fluid at a lower temperature than that usually required, will tend to diminish the chill which a metal will take under otherwise constant conditions.

Two elements are known to possess this power of lowering the fusing point of iron, in much the same manner as antimony and bismuth lower the melting point of the so-called fusible metal. These are silicon and phosphorus. The first has long been known as the softener of iron, and when considered in connection with the fusibility of metals, readily makes plain the reason. Its power to diminish shrinkage is also readily explained by the above facts. However, it should be remembered that only within certain well defined limits is its action beneficial. Thus, in cases where 3% would be of great value, 6% of the same element would be positively injurious. This accounts for many foundrymen having had the seemingly paradoxical experience of reducing their shrinkage by taking out some high silicon iron from their mixture. In regard to phosphorus, its properties, when in combination with iron, are so well known as not to require comment.

Coming back now to the question, by Bessemer iron is usually meant metal containing silicon 1.25%, sulphur .069%, phosphorus .09% and manganese .25%. If this were added to mixture containing .8% of silicon even if added only in small quantity, it would seem that the chill would be diminished, since the silicon would be increased. But the phosphorus would also be lowered, so that this might in part offset the effect of the silicon.

The low sulphur would probably tend to diminish both the extent and hardness of the chill.

It has been stated, upon good authority that the most potent factor in use in car wheel shops for reducing the depth and hardness (brittleness) of the chill is ferro-manganese.

By its use as high as 85% of wheel scrap may be used with but 15% of pig iron.

Question:—Would 5% of steel added to the above mixture with or without Bessemer iron in it, have the chemical effect of making the chill harder?

Answer:—Usually 5% of any one particular grade and brand of iron will have very little, if any, noticeable effect on a mixture. If 5% of steel would produce any appreciable effect, it would make the chill softer, although tending to increase its depth, since steel is practically pure iron. Its presence in the mixture would tend to decrease the carbon content, and hence diminish the hardness of the chill.

It is to be regretted that investigators have had at their disposal no means of determining the definite hardness of any metal even comparatively until very recently. However, with the machine recently brought out by Mr. Bauer, these tests can be made in a practical manner, which will give gratifying comparative results, if of little value in an absolute way.

Always Welcome.

THE FOUNDRY is always welcome. As a trade journal it brings us nearer to each other.

DAVID SPENCE,
Williamsport, Pa.

Something About Foundry Office Work—The Recording of a Day's Work.

By a Foundry Clerk.

The proper person by whom this work should be performed is the foundry clerk, and not the molder, at least in a good size foundry with a custom trade. I know from practical experience that it will annoy the molder a good deal to fill a sheet, even if plenty of time is allowed.

A well-filled foundry sheet forms the fundamental record, from which other records can be made. In order that the reader may see what is meant, I will show what we should find in a well-filled sheet for a day's work, or for one heat.

In the main each floor should form a chapter for itself, with molder or molders' name and time on top; each item therein must show:

1. Order and page number.
2. Customer's name.
3. How many pieces made.
4. Name of article with number.
5. Number of good castings.
6. Good weight.
7. Number of bad castings.
8. Bad weight.
9. Remarks.

The items are taken from the molder tickets in a way that the man weighing should easily understand; he should also be guided by such remarks as "hurry," "deduct so much for wrought iron or brass cast in," "return pattern with casting," "keep for carload," "will call for," and whatever is important for him to know. Remarks made in this manner will save him a good deal of running back and forth. A good sheet must also show what is characteristic to a casting whether "right" or "left" or 'special," and so forth. Proper credit should be given a molder who is called away from his floor during the day, to help another, while on the other hand the molder who is benefited should have such time charged on his record. Sheets which show all this are safe deposits from which the clerk may draw in case of emergency In a malleable foundry the recording is somewhat different, and while I am at it I may, for the interest of some readers, describe the modus in such a plant. In most places two days' work form a record for half or all the molders. Pouring is done mornings near noon and evening hours. The second day in the afternoon the timekeeper will visit each floor, and take

1. The molder's name.
2. The number of molds for each article (with number).
3. The order number.
4. The name of the customer.

This, however, is all for the present. After the work is all assorted in the assorting room, the number of good pieces or may be the weight only is marked on a slip with the molder's name on top. This tag is handed to the timekeeper, he will enter the count, or if no count, but weight only given, find from a register what one mold represents in weight, thus the number of molds are secured, the rate for one mold is marked down and the two items multiplied will show what the earnings are. From this sheet other sheets are extracted according to requirements.

The annealing furnace record has nothing to do with the production record, but it may be shown how it is secured. It does not matter from what production record the castings are when they come into the packing room. The packer when done with an article will hang a sample of it on a large blackboard, with chalk he will mark the number of pieces packed. When an annealing furnace is thus packed up, the timekeeper will record the number of the furnace, the date and time when lighted, and what the boxes contain as the blackboard will show; the book used for this purpose is called the furnace book, it is not identical with a regular foundry sheet, but only mentioned for the interest of some of the readers. Not every foundry can afford to hire expensive clerk help, I admit this, but when office work is to be done, it should be done in such a way that proper records of the past are secured, because for the future we may learn from the past.

From Other Lands.

In the latter part of 1897, Martin Fox, president of the Iron Molders' Union, made a trip abroad and some of his observations while on that tour have lately appeared in the Iron Molders' Journal. Mr. Fox has always shown his ability to look at both sides of a question and hence his writings do not have that pessimistic ring so common to the majority of those who write of the condi-

tions of labor. Speaking of Paris Mr. Fox says: "Under the guidance of our friend, Vigoroux, we paid a visit to a French foundry. It was not an iron foundry, however, for from what I could learn there are few of these in Paris, but the statuary foundry of M. Leblanc Barbedienne, established 1839, and said to be the largest and most complete, of its kind, in the world. This branch of the molding trade can not, of course, be compared with the commoner branches. But I was struck with the easy and deliberate movements of the workmen and the precision with which they manipulated the numerous drawbacks and sections of their intricate work. The small tools they use are of endless variety and are all laid out on a bench before them ready to be picked up as occasion required.

The sand they use is of a peculiar, plastic nature and can be handled much like clay or putty. The molders wear the same light blue blouse of other artesans, and earn, as I was told, from 9 to 13 francs (from $1.80 to $2.60 per day. The proprietor informed me that the longer a man had been in his employ the more valuable he considered him. The apprenticeship is nominally a period of four years, but before a man becomes an expert it would take a much longer period. The melter, who also superintends the pouring of the metal, gets 15 francs ($3.00) per day. We were shown every courtesy by the firm, who seemed to appreciate the interest we took in their work, and were ever ready to enlighten us.

Before leaving Paris we were entertained at dinner by M. Louis Vigoroux and his colleagues of the Musee Social. Many of our readers would, no doubt, like to be enlightened as to the functions of the Societe du Musee Social as it is called. This society was established about two pears ago by the Count of Chambrun, for the purpose of supplying the public with reliable information on any institution or organization that really succeeds in its endeavors to better the material and moral welfare of the workers. It is equipped with a splendid library of about 9,000 volumes and cosy reading rooms for the use of its members and those who patronize the institution. Already commissions have been sent out to study the labor and social questions in foreign countries. It was as a member of one of these that Mr. Vigoroux visited America to study the trades-union movement. All political and religious discussions are forbidden, and as a result it is expected that the information it can afford will be eagerly sought after by all classes of the community who take an interest in promoting the advancement of the race.

"Although our time was now limited, I expressed a desire to visit the home of a French laborer, and again Mr. Vigoroux's kindness helped me to its gratification. At the hour when the day's work was about completed he took us to a tile factory and introduced us to one of the teamsters, who, on being informed of our desire, expressed his willingness to oblige us and led the way to his humble home on the fourth floor of a tenement. On being ushered into his quarters I found that it consisted of but two rooms, and not very large ones at that, with just enough furniture to answer the purpose of necessity. The floor was of tiling and carpetless but everything was as clean and tidy as a pin. Our hostess was as courteous and sociable as her good man, and although taken by surprise by her visitors, urged us to share with the family, which comprised two bright little children and the parents, their evening meal. Naturally, I was curious to see what kind of apparatus they had for cooking and heating purposes and to my surprise found that a little two-holed charcoal stove performed the service. I was informed that the weather is not, as a rule, cold enough in Paris to necessitate the artificial heating of dwelling houses, while the food in a working man's home is of such a simple character that the stove referred to is ample for cooking purposes. I noticed that the evening meal on this occasion consisted of cauliflower and potatoes and the common but pleasant red wine in general use here. It would neither be wise nor fair to speak of the French workman's condition from observations made in one home, but I was assured that this one was typical, and I will venture no further than to say, they are happy and apparently contented with much less thn an American in the same station of life."

Returning to a land whose interests are largely our own, Mr. Fox speaks of several places in Great Britain, where many of our iron workers obtained their first training. Beginning with Dublin, he says:

"The decadence of Dublin as a manufacturing city was well exemplified in the foun-

dry interests as they were represented to me by Mr. Sharkey, the proprietor of the Eagle Foundry. From him I learned that at one time as many as from 300 to 400 molders had been employed in the different foundries of the city, but now there were but 60 or thereabouts. Molders work here under much the same system as they do in England. They start to work at 7 a. m. and work till 9, when they take three-quarters of an hour for breakfast and a 2 p. m. a similar interval for dinner, quitting work at 5:30 p. m., except on Saturday when work ceases at 2 p. m. They work, therefore, 51¼ hours per week and their average wage is 36s. ($8.75) per week.

"As our time in Ireland was necessarily very limited we could only spare one day for Dublin, and then took train for Belfast. On Irish as on English railroads the compartment coach is always in evidence, but on the former they are of an inferior make. We did not think of these matters, however, for this short railroad journey would afford us the opportunity of looking upon an Irish country district. I am informed that the inhabitants of this section of the island are, as a rule, most thrifty and industrious and make the most out of their limited opportunities. That these opportunities are limited in the farming communities, at least, was evident from the car windows. The holdings appear to be so small as scarcely to merit the name farm, and one wonders at the ability of the farmers to make a living on them. But there they are—hundreds of them—dotted with queer little farm houses or cabins with straw-thatched roofs and quaint little windows of four 8x10 inch, or less, panes of glass. They were not overburdened with outbuildings from what I could see, indeed there was no room for them, and I can now more readily believe the story that I was formerly constrained to doubt, that by virtue of necessity the old sow is, in some cases, the recognized occupant of a corner in the parlor. We also passed some of those embryo coal deposits—the peat bogs—and marveled at this wonderful dispensation of nature that in the death and decay of its plant life, finds a means of storing up the light and heat of the sun for the use of future generations of the children of men.

"Unaccustomed as I was to the native tongue, when I arrived in Belfast, I was at once impressed with the dialectic peculiarity in the speech of the Belfast people. It seemed to me to be closely akin to Scotch, and when we reflect upon the history of the province of Ulster, and the manner in which it was first settled, this need excite no surprise but be accepted as the natural sequence of events.

"The city has a population, I believe, of about 260,000 and has all the earmarks of a live and thriving manufacturing center. It is by long odds the foremost manufacturing city of Ireland and stands well up in the list of British cities. Its streets are clean and substantial and the general surroundings pleasing to the visitor. We were fortunate in making the acquaintance of several representative labor men and got a good insight into the general condition of the Belfast mechanic. Among these was Mr. W. J. Montgomery, local secretary of the Friendly Society, and through his good offices I got an opportunity to visit some of the foundries. It may seem to some a little strange that I should have spent so much of the short time at my disposal in the foundries when there was so much else of interest to be seen around us. But it will be remembered that one of the chief purposes of my visit to the United Kingdom was to effect a comparison from personal observation and inquiry, between the condition of the molders of the old land and their fellowcraftsmen in America, and to endeavor to effect a closer relationship between their respective organizations. So that while there might have been many more pleasing prospects than the inside of a molding shop, none were of more practical value from my point of view.

I had a great desire to see the famous foundry of the Harland & Wolff Marine Engine Co., but ill-luck seemed to be my constant companion in Ireland, for the last Saturday in August was some kind of a holiday, and the majority of the shops were closed, among them the one mentioned. However, I secured a good description of the establishment through the foreman of the molding shop. The company, I am told, was organized some 17 years ago and now employs in the neighborhood of 170 molders, all union men, on marine engine and ship building work generally. There are three traveling cranes in the molding shop, one of 30 tons capacity, and two of 10 tons. Needless to say all branches are represented in this foundry—green sand, dry sand, and loam; the wages paid is, for sand molders 37s.,

and for loam hands, 39s., per week. They make engines of from 250 to 30,000 indicated horse-power. Two of the latter capacity are at present in course of erection and are the largest set of engines they have yet built. The bed plates for these engines are in four pieces, each pieces weighing 30 tons, so that each bed plate weighs 120 tons. There are 16 column legs to support the cylinders, eight for each engine, weighing 12 tons a piece. The vessel for which they are being made is on the slip and it is expected she will be able to beat all records. This firm, although one of the largest in the Kingdom, refused to join the Employers Federation that fought so long and bitterly the Amalgamated Society of Engineers and notwithstanding the threats of boycott that were freely used by the Federation against them, they stood steadfastly by the men. Mr. W. J. Pirie, the head of the firm and also Lord Mayor of Belfast, at a public dinner recently boldly condemned the coercive measures adopted by the employers, and stated emphatically that the source of their trouble in meeting the competition in the markets of the world was their own culpable conservatism.—(Later reports from Belfast indicate that the boycott to which Mr. Fox refers has actually been placed against Messrs. Harland & Wolff. Thus we see that tyranny is not confined to labor organizations exclusively. When the Employers Federation defeated the Amalgamated Society of Engineers, the majority of trade papers on both sides of the Atlantic, anxious to appear on the winning side, done considerable shouting about the effectiveness of the Employers Association and we agree that as long as such a body is administered with justice to all concerned, employer and employe alike, it has within it the power to accomplish much good. But just as the Amalgamated Society of Engineers in many cases overstepped the boundaries of reason by obnoxious restrictions so the Employers Association appear to be going outside of its own sphere to hunt for trouble, if reports of their action towards Harland & Wolff are true. Many labor organizations have hung themselves when they made unrestricted demands that they only should be allowed to exist. The British employers could not throw away the result of a hard-earned victory as easily as by attempting the coerce those whose opinion differ with them, in fact overconfidence is a rope that usually strangles the best organized society. As for Harland & Wolff we have no doubt but that they will find all the assistance they need on this side to successfully combat the united efforts of their competitors.—Ed. Foundry.)

I had better luck in two of the other foundries, that of James Moore & Son, employing fifty-four men, and that of the Victor, Coates & Co., engine and millwright works (the Lagan Foundry), which only had thirteen molders at work owing to the engineers' strike. Both of these were well equipped for the heavy class of machinery work that is their specialty. In answer to an inquiry as to the average output per man on this class of work, I was told that thirty molders would average fifty tons in a fifty-four hours' week.

The working hours are somewhat different to what obtains in Dublin. The men start to work at 6 a. m. stop 45 minutes for meals at 8 a. m. and 1 p. m., and quit at 5:15, except on Saturdays when they quit at 12 m.

At Glasgow, Scotland, we visited the foundry of J. King & Sons, manufacturers of sullage pipe, ranges, bath tubs, etc. This foundry employes about 125 molders, but as a specialty shop did not impress me very favorably. There did not seem to be the same order and neatness in the appearance of the floors; its equipments, either in the matter of flasks or other facilities, to expedite the molders' work, were not on a par with those found in a similar American foundry. I did not have a good opportunity to examine closely the castings themselves, but I could see that their stove-plate and range castings were much heavier than ours, and altogether lacking in that ornamentation which makes American goods so attractive to the consumer. It is only fair to say, however, that stove manufacturing is a much younger industry here than in our own country, and from what I learned, the stove manufacturer has to accommodate his wares to the peculiar prejudices of the British mind, which are hard to uproot.

We next visited the Marine Foundry. It was evidently an old establishment and had not kept pace with its more progressive neighbors in the matter of facilities, but they did a first-class line of heavy marine engine work, and it was truly wonderful to think

how they could handle the immense castings with their limited facilities. I found them rushed with work. They had molders in every nook and corner in the shop, and out of the shop too, for I found molders working on a bed about fourteen feet square in the open air. In case of bad weather they used a sheet iron roof as a covering. I noticed a double-compound cylinder weighing about twenty tons, that had just been removed from the pit, and out of curiosity asked how long it had taken to make it, and was informed that five molders and two helpers had worked on it a month. As an example of the poor facilities I was told of one instance where they had to carry the iron for a twenty-ton casting a distance of 100 feet in 200-pound ladles.

I cite these particulars not to disparage the foundries of Glasgow, but to show what is done in some of the older shops without the aid of modern shop facilities. In Glasgow they do some of the finest machinery work in the world, and no doubt have molding shops which, in point of equipment, compare favorably with any, but on this occasion it was not my good fortune to get around to them."

"Why is the First Iron 'Down' in a Cupola Harder Than the Succeeding Iron, Mixtures Being the Same?"

By W. H. KREMER.

The question is suggested in the article by Mr. Smith in THE FOUNDRY for March, and as there seems to be some difference of opinion as to the cause, a theory, briefly outlined, may be acceptable.

The iron on leaving the "melting point" of a cupola, does so, in dribs, globular in form, coming in contact with the fuel on its way to the bottom, it is deflected, when uniting with other dribs, it forms a stream more or less intermittent. On its passing the tuyeres the blast comes in contact with it in its comparatively finely divided state. The action of the blast having the effect to chill the iron, partially eliminating and combining its graphitic carbon.

On the iron reaching the bottom, owing to this, and the sides not having a heat equal to the melted iron, it is again chilled and more G. C. is converted to C. C.

By the time the first charge is down, small ducts and veins are formed within the fuel below the "melting point," by slag and other impurities, adhering to the fuel, the melting iron keeping the passage open in the ducts, during the entire heat.

As soon as formed these passages protect the iron in its downward course from any action of the blast, hence no material change occurs in the iron on account of the blast. When the iron reaches the bottom, the latter being heated up by iron previously passing over it, it will not be subject to the chill which the previous iron was accorded, and again we have less cause for variations in mixtures than we had in case with our first charge.

Considering the above as facts, it seems no strange matter why affairs are thus.

To remedy the matter would suggest in light charges, the use of an average mixture of about 1.00 per cent higher in graphitic carbon for the first charge, over that of succeeding ones providing uniform iron is desired throughout the heat. Silicon seems to have only a secondary influence in this instance, the elimination and conversions of the carbon being the important actions taking place, and which require close attention in order to rectify the fault.

The Utilization of Aluminum in the Arts.

By ALFRED E. HUNT.

(Continued from March Issue.)

One of the most promising uses of aluminum at the present time is in the fabrication of aluminum cooking utensils.

The lightness, difficulty of corrosion, ease of keeping clean, high thermal conductivity and comparatively high specific heat of the metal, make its use for cooking utensils particularly advantageous.*

The cast aluminum tea-kettle is certainly an improvement in household economy, of which every housewife who has used them can speak enthusiastically.

A complaint has been made of aluminum cooking utensils that they turn black by

*That the Institute may know what the opinions of some of the large manufacturers of aluminum cooking utensils are, I quote from a letter of February 12, 1897, from the Griswold Manufacturing Company, Erie, Pa., one of the largest manufacturers of iron hollow-ware cooking utensils.

"It is about four years since we commenced to cast aluminum into cooking utensils. We began in a small way, and have continued with a constantly increasing demand ever since,

wear. This has sometimes been occasioned where the metal has been subjected to the action of sulphuretted hydrogen, and where the aluminum contained a sufficient amount of copper alloyed with it to form a black sulphide of copper on the surface of the metal; but by far the largest portion of this difficulty can be attributed to the action of ammonium salts, which gradually attack the surface of the aluminum, leaving behind a coating containing silicon, which, although rapidly attacked by concentrated alkali, resists very many solutions of organic matter, as well as moist or dry air. An aluminum surface which has thus been treated has a brown or blackish color. It is really a very serviceable way to treat the metal for a durable finish, to withstand corrosion; but it has occasioned complaint on the part of those who do not understand the phenomenon as being caused by impurities in the aluminum.

I have investigated several such cases, where only the purest commercial aluminum has been used, and have found that the discoloration referred to was of this surface coating of metallic silicon on the metal.

This action need occasion no anxiety on the part of users of aluminum cooking utensils, as there is no injurious action in the discolored coating, which may be removed by treatment of the aluminum with caustic alkali, doing this by rubbing the metal with a rag dipped in alkali in a way to avoid too serious corrosion of the aluminum. Care, of course, should be taken by one using caustic alkali not to burn or corrode one's hands, as well as the aluminum. With the exception of the looks, this coloration need cause no uneasiness, for there is no real detriment to the healthful use of an aluminum cooking utensil so discolored.

On the other hand, if simply boiling water in a pure aluminum cooking utensil causes this marked black discoloration of the metal, it is a serious indication that the water used is not above reproach, and it usually indicates that the water contains a considerable proportion of free ammonia in solution, which may be occasioned by contaminating sewage.

One of the great advantages of aluminum is that the salts which are occasioned by its corrosion are not in any way poisonous.

Aluminum can easily be kept free from corrosion by the same care that is bestowed on bright work of brass or other metals. In fact, with one-half the work required to keep brass work polished, aluminum can be kept with a nice polish.

Pure aluminum is not by any means as readily corroded as the alloy. The natural impurities of aluminum are silicon and iron, and both tend to render it more easily corrodible than the pure metal. With imperfectly made aluminum, metallic sodium is sometimes alloyed with the metal. Its presence occasions the rapid corrosion of the aluminum.

If the aluminum has been overheated in its molten condition, it is liable to occlude gases, especially nitrogen, which occasions an open, stoggy, porous metal, which is more easily corroded than pure aluminum.

My experience with cooking utensils and similar articles, where corrosion has occurred, is to the effect that the cause of the trouble can be traced back either to an excessive amount of hydrochloric acid or chloride salts, or to the presence of caustic alkali solution in contact with the metal.

All aluminum surfaces in utensils, after being wet, should be carefully dried off, if practicable, for with almost all forms of metal one of the most serious forms of attack is by alternate exposure to water, which is allowed to gradually evaporate or dry on the metal; the residues in the water occasioning dirt to settle upon the material and some little corrosion is occasioned on almost every form of metal.

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until now the outlook for sales is exceedingly promising, and the amount that we reasonably hope to dispose of this year will be very large." Similarly, I quote from a letter from the firm of Sidney Shepard & Co., Buffalo, N. Y., February 12, 1897, one of the largest manufacturers of stamped metal ware in the country:

"Aluminum cooking utensils are destined, as soon as the extreme hard times which have existed for the past two or three years are over, to meet with a very large sale, for the reason that those who have used them have, in almost every instance, expressed themselves very favorably in reference to them, and our trade has been considerable, notwithstanding the fact that the goods are now unappreciated and higher priced than other ware on the market."

And from the Hill-Whitney Aluminum Company, of Boston, Mass., also large manufacturers of aluminum cooking utensils, under date of February 24, 1897:

"Our cast aluminum tea-kettle business is increasing continuously, as people know the value of such a utensil, and we believe, in the general line of goods, there has been only a beginning."

Cast aluminum bath tubs, sinks and similar plumbers' supplies are now being made by the Western Brass Manufacturing Company, of St. Louis. I have in my own home a cast aluminum bath-tub and cast aluminum sink, both of which are giving excellent satisfaction. Both, however, require care in being washed clean from the soapy residue after use; but with such reasonable care as is ordinarily taken in keeping iron free from rust, these articles are giving excellent satisfaction.

Aluminum has been used quite extensively for oil cups and other parts of light-running machinery, where reciprocal motions are made and the momentum of the moving parts occasions considerable strain upon the material. In such cases, the lighter weight of aluminum has been of special advantage.

SHRINKAGE OF CASTINGS OF METAL.

	Inch to the Foot.
Pure aluminum (13-64 inch)	.2031
"Nickel Aluminum Casting Alloy" (3-16 inch)	.1875
"Special Casting Alloy" of the Pittsburgh Reduction Company, (11-64 inch)	.1718
Iron, small cylinders	.0625
" pipes	.125
" girders, beams, etc	.100
" large cylinders, contraction of diameter at top	.625
" large cylinders, contraction of diameter at bottom	.083
" large cylinders, contraction in length	.094
Thin brass castings	.167
Thick brass castings	.150
Zinc	.3125
Lead	.3125
Copper	.1875
Bismuth	.1563

Aluminum, especially in forms where it is alloyed with a few per cent of hardening ingredients, is now being used very largely in castings of all descriptions, where lightness, non-corrodibility, or a silver color is desired. The alloys most used in general castings have a tensile strength of about 20,000 pounds to the square inch, and are about one-third the weight of brass.

The same general method is followed as in making brass castings. Either iron or sand molds can be used. The metal should be poured as cold as possible, in order to insure sound castings, free from blow-holes (caused by the very great absorption of gas by overheated molten aluminum), or cracks and depressions due to shrinkage. It is also desirable in most cases to use large gates and risers, as a further safeguard against these defects. The gate should be put in such a place on the casting that the metal will not "draw away" where the gate joins the piece. Particular care should be used for this reason in making "gated patterns."

The practice of some molders is to immerse small quantities of nitre in molten aluminum to purify it, the oxidizing effect of this salt undoubtedly acting somewhat beneficially if care is taken to see that all of the potash salts are allowed to come to the surface and are skimmed off to prevent contamination of the metal.

The method of adding nitre in foundry practice is as follows: After the metal is removed from the fire, and before pouring slightly dampen a sheet of writing paper with water. Put in this paper one tablespoonful of nitrate of potash to about 100 pounds of metal. After the nitrate of potash has been wrapped in this paper, it should be placed on the top of the molten metal, and instantly, with an iron rod or stick, it should be pushed to the bottom of the pot. By the time it reaches the bottom the paper burns, and the nitre comes up through the metal, combining with the oxide as it comes to the surface. It is then skimmed off.

Charcoal is the best fuel to use in melting aluminum, and should be used in all cases where especially good castings are desired. Both coke fires and natural gas are successfully used in melting aluminum. Care should always be taken, not only to not overheat the metal but also to prevent the occlusion of gases in aluminum. Both nitrogen and hydrocarbon gases are especially liable to be absorbed by molten aluminum. Care should

also be taken to have the molds well vented.

Aluminum is melted in ordinary plumbago crucibles, such as are used for melting brass. If the metal be not overheated, it will absorb no appreciable amount of silicon from the crucible. Aluminum remelted twenty times in such a crucible showed only an addition of 1-10 of 1 per cent of silicon.

No flux is needed to cover aluminum, for it is non-volatile at any temperature that can be attained with any ordinary coke fire without blast. A very thin film of oxide forms on the surface of the molten metal, which, while not enough to injure either ingots or castings, protects the metal from further oxidation.

Aluminum has been used quite largely in improving the quality of brass castings. Brass is a mixture of copper and zinc, as distinguished from the bronzes, which are alloys of copper and tin. The proportions commonly used in making brass are 66 parts copper, 34 parts zinc. It is customary in the manufacture of ordinary commercial brass to introduce from 2 to 5 per cent of tin for the purpose of giving added strength and density.

The terms "high brass" and "low brass" are used in the trade, but apply only to rolled material. High brass is composed of 2 parts copper and 1 part zinc, being a light color. Low brass is composed of 75 to 88 per cent copper and 25 to 12 per cent zinc, and in color is considerably darker than high brass. In ordinary commercial practice, cheap brass is a very heterogeneous material, much of it containing lead and some iron alloyed with it, either accidentally or for the purpose of giving an additional weight of cheap metals.

Aluminum has been added to brass with advantage in giving a stronger alloy. It has been used in all proportions from 1-10 of 1 per cent to 10 per cent; and the best results have been obtained by introducing the aluminum in the form of aluminized zinc. This is added in the same manner as zinc is ordinarily introduced into the copper, and in such proportions as will give the requisite amount of aluminum in the brass mixture.

The effect of aluminum in brass, added in this manner, in small quantities of less than 1 per cent, is mainly to make the brass flow freely and present a smooth surface, free from blow-holes. When used in these quantities, from 1-2 to 1-3 more of small patterns can be used on a gate than can be used without the presence of the aluminum, for this amount of aluminum gives the brass such additional fluidity as to cause it to run more freely in the molds and to a greater distance; consequently more patterns can be used on a gate. In quantities of over about 1 per cent. the effect of the aluminum commences to be very perceptible, from the fact that it imparts to the brass additional strength, and this strength is increased directly as the percentage of aluminum is increased, up to about 10 per cent. One per cent of aluminum in brass is very extensively used for electrical purposes, as it gives a brass casting free from pin-holes and of greater strength than can be secured otherwise, from the same grade of brass. It follows, therefore, that by the use of a small percentage of aluminum in brass, a cheaper grade of brass can be used to do the same work than would otherwise be possible.

In all cases, if maximum results are desired, care must be taken that only pure metals are used. In connection herewith, it should be clearly understood that much of the copper and zinc commonly used contains considerable amounts of impurities, and the nature of some of these impurities is such as to absolutely prevent the production of good alloys with aluminum. In all cases, we would advise intending purchasers to insist on being furnished with an analysis of the metal supplied, and from aluminum alloys, to exclude all containing more than 1-4 of 1 per cent of iron, arsenic, or antimony, or more than 2-100 of 1 per cent of bismuth. Alloys should be poured at a low heat as soon as fluid.

It should be noted that the presence of aluminum in these alloys lowers the point at which they become fluid, and that they are fluid at lower temperatures than either gunmetal or ordinary brass mixtures; therefore the average brass founder is very liable to overheat them, and great care must be taken to prevent this.

The use of aluminum in cheap ordinary brass mixtures has sometimes occasioned the complaint that the surface of the brass castings is made black by the addition of the aluminum. This is due to the sweating out of the lead from the brass mixture, which the impure brass has contained.

It is not advisable to use aluminum in brass which is to be dipped in acid, as the aluminum, even in small quantities, makes the metal withstand the action of the acid so completely that the dipping is not suc-

cessful. For this reason brass, which is subject to corrosion, is found to withstand this corrosion much better if it contains a proportion of aluminum, up to say, 10 per cent.

The main objection to the considerable addition of aluminum to brass is the increased shrinkage of the alloy occasioned by the use of the aluminum. This has to be provided for by pouring the metal not too hot and using large gates and risers.

Aluminum-brass has an elastic limit of about 30,000 pounds per square inch and an ultimate strength of 40,000 to 50,000 pounds, with an elongation of 3 per cent to 10 per cent in 8 inches.

The use of aluminum-bronze is gradually increasing, for purposes where a strong and dense metal is required.

On account of the difficulty of making sound castings, and especially in rolling ingot-slabs capable of turning out sound sheets, the business has grown much more slowly than the bright prospects claimed for the use of aluminum-bronze eight or ten years ago would seem to indicate.

It is necessary now in the preparation of rolling slabs of aluminum-bronze that each ingot shall be planed off on the top until sound metal is obtained below the blowholes, which always exist on the surface of the castings. This planing of the metal is expensive, due to the hard, dense character of the metal.

In the manufacture of aluminum-bronze, the best results will be derived by following closely the following method of manufacture:

Both the copper and the aluminum should be carefully selected, and none but the purest "Calumet and Hecla Mine" or "Lake" copper should be used and the aluminum should be guaranteed to be at least 99 per cent pure.

The copper should be placed in a plumbago crucible, and melted over a charcoal or coke fire; these being the best fuels to use. Next to charcoal or coke as a fuel for melting comes oil, and then natural gas or producer gas. It is impossible to make satisfactory aluminum-bronze over an ordinary coal fire, for the reason that the copper will absorb the gases from the coal. The copper should be covered with charcoal to prevent as far as possible oxidation and the absorption of gases, as there is always the liability of a small amount of gases being present, even in using the fuels previously mentioned.

After the copper has been melted, and the time has arrived to introduce the aluminum, the crucible should be grasped with tongs in order to remove it from the fire instantly, and the percentage of aluminum which it is desired to add, dropped into the pot through the charcoal.

In large pots of bronze, the pot may be removed from the fire before adding the aluminum. As soon as the aluminum goes into the pot, the first action, to a certain extent, will be a cooling one, caused by the actual temperature of the aluminum; but as aluminum and copper form natural alloys (i. e., combinations in atomic proportions), the aluminum, as soon as it is heated to its melting temperature, enters into combination with the copper, by which a large quantity of latent heat is set free (or made sensible) by the chemical union of the two metals, and consequently the temperature of the mass is raised. If the mixture be watched, one can tell as soon as union takes place, for the reason that the copper will become more liquid, and also turn a little brighter in color.

This occurs in an instant after the aluminum is introduced; then, if the crucible has remained on the fire, it should instantly be removed, the charcoal skimmed from the surface, and the metal, which is now aluminum-bronze, poured into molds of any convenient size, keeping the liquid metal in agitation by constant stirring until it is poured, in order to insure that the aluminum is as well disseminated through the alloy as possible.

If these points are strictly adhered to, good castings can be produced.

After this aluminum-bronze has become cold, it should be re-melted and poured into molds as desired, for the purpose of manufacturing finished castings. Aluminum-bronze is found to improve with each successive re-melting and casting, until this has been accomplished three or four times, for the reason that it seems to give the aluminum a better chance to become more freely disseminated .and form a more uniform alloy with the copper.

The amount of aluminum in aluminum-bronze varies from a few per cent up to 10 or 11 per cent, depending on the purpose for which the metal is intended. The strongest mixture contains between 10 per cent and 11 per cent of aluminum. Beyond this point the bronze is hard to work, and becomes brittle.

In castings, aluminum alloyed with about 5 per cent of copper to harden it is just beginning to be used to replace brass castings in electrical apparatus. The aluminum alloys used are as easily tooled and take as good threads as brass castings, and the electrical conductivity of the alloys used has been fully up to that of ordinary brass, and better even than that of ordinary copper castings, for the reason that copper, as it is ordinarily treated in making castings, absorbs a great deal of oxygen, which causes it to have markedly lower electrical conductivity than rolled copper, which, although reckoned at 100 per cent, is often lowered to 30 per cent in copper castings. Nickel-aluminum castings have been made with a conductivity of 50 per cent in the same scale.

The tensile strength of ordinary copper castings is about 19,000 pounds per square inch, and, in the best results with specially prepared copper castings, has never exceeded 30,000 pounds per square inch, while the nickel-aluminum casting alloys can readily be supplied of a tensile strength per square inch of 25,000 pounds.

Looking for a Hot Time.

Curiosity prompted the Times-Union man to look up the "warmest" place in Albany, so he hied himself to West Albany, and to the mammoth foundry owned by the New York Central Railroad Company.

Within the foundry everything was work, work, work. Experienced men watched the molten iron in the furnaces, and others, with long ladles, poured it into molds and left it to cool and assume the form of the mold itself.

Here castings used on locomotives, bumpers, drawbars, driving boxes, weighing 500 pounds, driving-wheels, etc., are made.

The temperature when the molten metal is being poured off approximates nearly 115 degrees. The workmen go about clothed in rags, and even on the coldest days suffer from the intense heat.

The normal temperature is about 90 degrees. The blast furnace is daily in use, and the long, heavy clouds of smoke and lurid flames which leap in mad confusion, resemble the eruption of a volcano.

The "hottest" time the workmen have is in the molding of the larger castings. It requires over twenty-four hours for them to cool before removal.

The iron is prepared by smelting. This metal is locked up with oxygen in an apparently useless stone. Carbon is the key that is ready-made and left for our use by the Creator. The process adopted is as follows: A tall blast furnace is constructed of stone and lined with firebrick, as is the one at West Albany. At or near the top, is a door, and at the bottom are pipes for forcing in hot air, sometimes twelve thousand cubic feet per minute by means of pistons driven by steam power. The furnace, after a fire has been started, is filled with limestone, coal (charcoal or coke) and iron ore in alternate layers. The carbon unites with the oxygen of the ore, and goes off as carbon monoxide and carbon dioxide.

The iron, as it is reduced from the slag, sinks in the molten state to the lowest part of the furnace—the crucible—covered with a layer of slag. The slag runs out in a constant stream from an opening at the proper height, while the iron is drawn off and run into molds. In its new form—cast iron—it is brittle, cannot be welded, and is neither malleable nor ductile.

The reason why it is used for castings, etc., is because it expands at the instant of solidification, so as to copy exactly every line of the mold into which it is poured. These castings may be made so soft as to be easily turned and filed, or so hard, by cooling the iron molds, that no tool will affect them.—Albany Times-Union.

One of our Albany patrons, Mr. Charles M. Page, forwards us the above with the remark, that most people have a whole lot to learn about the foundry business. We agree with him. The only thing which the Times-Union man missed in his visit to West Albany was the soaking pit, wherein his head should have been kept about a week to guard against being cracked on exposure to the atmosphere.

The Last of a Historic Foundry.

The old brick building at Rome, Georgia, known for years as "Noble's," and long since devastated of all its machinery and glory, has been torn down and its bricks used in the construction of the handsome and modern new depot of the Nashville, Chattanooga and St. Louis railway, just thrown open to the public.

During the war this was one of the best known foundries in the south, and a great

many of the cannon used in the confederate army were manufactured right here.

It is said that the first lot was paid for in good money, the second was paid for in confederate scrip and after that none were paid for at all and nobody bothered about whether they were paid for or not.

Here it was that Noble Bros., the founders and developers of Anniston, laid the foundation for their subsequent wealth.

When General Forrest was in Rome toward the latter part of the war he was supplied with cannister and round shot from this old foundry, and it is related that several yards of railroad, a couple of iron fountains and every tin can in the city was pressed into service to furnish the necessary material for the manufacture of the shot.

This foundry was run during the war for the ostensible purpose of manufacturing car wheels, but the number of cannon turned out as compared with the number of car wheels turned out would have opened the eyes of the union generals had their attention been called to the matter. The operation of the foundry was kept a most profound secret, and during the latter part of the war it was one of the most important sources of supplies that the south could call its own.

Up to its present destruction it had stood unmolested and alone, the home for bats and birds—a monument to past greatness. The old sign, "Noble Bros., Car Wheel Foundry," stood forth until its last day, proclaiming its glory and magnificent history. This was the very first important enterprise of which Rome ever boasted, and the destruction of the building causes sadness in many hearts. 'ts removal is a source of regret to all.

Mr. James Noble located in Rome in 1855 and immediately built the Noble foundry. The principal manufactures of that time were light iron wares, such as grates, mantels, pipes and the like. The first grate of which Rome ever boasted was made here and placed in Mr. Noble's own residence. It was considered a great luxury, and rather foppish.

When the call to arms was sounded and all southerners responded, the Nobles were among the first to go to the front. President Davis, of the confederacy, very promptly sent them home, especially delegated to conduct their foundry for the manufacture of ordnance for the confederate armies. At that time all cannon was made of brass, and, as the material supply began to run low, church bells and school bells from all parts of the country were sent to Rome and very promptly, if somewhat reluctantly, converted into cannon of the most approved kind.

Mr. Noble steadfastly refused to allow the Rome church bells to be used for this purpose until, at last, the dinner bells, cow bells and every other kind of brass implements having been completely exhausted, the Rome church bells were rung in, so to speak, and converted into cannon for the use of the boys in gray.

Round shot and shell were made here in the greatest abundance, and President Davis relied strongly upon the Nobles for these supplies. A cannon test was an almost every-day occurrence in Rome, and it is said that not one single cannon turned out by the Nobles was ever refused by the government on account of defect, and many of them can be seen until this day, in different parts of the country, bearing the then familiar mark of "Noble Bros."

The foundry was supplied with pig iron from the company's furnaces at Cedar Bluff, Ala., and they had rather easy sailing during the early part of the war. A messenger brought the unwelcome news one morning that these had been destroyed by a detachment of General Blair's soldiers, and, after that, it was simply a question of getting iron from any old place available.

When the federal troops took possession of Rome, Mr. Samuel Noble, who was then a prisoner in the north on parole, went to President Lincoln and with rare tact secured permission to return to his home and protect his property.

He was too late, however, as Sherman's march to the sea had begun, and a detachment of his men had already laid the foundry in ruins.

With undaunted courage this pioneer of Romans went to work to repair his wrecked fortunes, and in a few short months the hum of industry was again heard in Rome, and their foundry was in full operation again. Never again was a cannon made here, however. The molders never more made implements of war. The plow took the place of the grapeshot, and carwheel the place of the cannon.

From that day to this the history of the old building has been one of good deeds and genuine usefulness. A few years ago the Nobles left Rome and founded the magic city of Anniston, Ala., and since then the old building has been only the shadow of a mighty past. Its destruction removes about the last of the old landmarks around Rome, and now that the old Rome railroad depot is gone, too, there is nothing much left in that end of the city to suggest the war and those stirring times.—Atlanta Constitution.

Blowholes in Iron Castings.

In these days of superior workmanship we still hear much of the so-called blowholes in castings. Recent inventions in the way of fluxes have not altogether removed these defects, although one would have thought, when these fluxes were being introduced into the trade, that a panacea for a very large percentage of the molder's troubles had been found. It does seem strange that should a casting have ever so small a hole showing itself on a finished part, the molder has to carry the weight of it all, whereas it is one of those faults which more properly belong to the iron smelter; or, if such a complaint as above indicated should appear in a more intensified form, the said fault is largely due to the engineer, or the one responsible for designing the casting. This intensified form is usually a "draw" through disproportionate metal, and 95 per cent of what are termed in finished work "blowholes" are simply misnomers, they being entirely due to shrinkage. I do not say that modern fluxes can in no way improve the founder's position; but while these may be useful in eliminating and giving increased fluidity, they never can densify disproportionate thicknesses. I have often wondered if the smelter, in his reflective moments, ever thought that he made bad castings, too. It matters not how much blowing a crude pig may show in fracture, this same product would have to be returned in the form of first-class finished work; and the fact of modern fluxes being so much to the front clearly indicates that much is at fault with pig metal for which the molder cannot be held responsible.

Many are the theories to explain the cause of blowholes; but as theorizing is merely speculative work, all such have proved of little account in practice. Once understood, it will not be difficult to remember that a blowhole—that is, a hole formed in a casting through the action of an air-bell—is always of a clear color ,and has a hard or chilled surface. A shrinkage or vacuum hole is generally of a bluish color, its interior being rugged, and at times takes the form of a rough spider's web. The contrast here is very decided; therefore, no one need be mistaken. No such holes as those of the latter description are to be found in proportionate metal. A very common form of blowhole is usually styled in foundry parlance a "blister." This form of blowhole is very common on pipes that are cast in green sand in the horizontal position. In this matter, opinion differs very much as to its cause. Some maintain that it is caused by too hard ramming of the top part or flask, while others maintain it is caused by the core being too hard; the latter being the true solution. More than twenty years ago I happened to be working in a shop doing a large trade in green sand column and pipe work. Along with others, I was at times troubled with blistering on the top side of those castings, they appearing so bad at times in a 9-foot length of pipe, that at a distance of about 2 feet from the flange of both ends (after breaking the skin, which is no thicker than ordinary silk paper) in several places of the space mentioned one could easily fit in the side of one's finger. These blisters are always hidden until by accident or otherwise they may be broken. The simplest way to find them is by rubbing the head of a fettler's hammer across the top side of the casting, and immediately the hammer passes across they will respond by a slight whistling sound. As a practical molder I have never found too hard ramming of green sand pipes to tend to cause blistering; neither do I regard the use of the vent wire in such work a necessity. The hardest ramming of sand retains sufficient porosity to admit easy exit of the gases. Again, a top part that may be rammed up with too wet sand would never retain its metal. The chances are that immediately it was cast it would emit its metal with such a spluttering that no hope of saving it would be possible. A core that is too hard may be so from two causes—first, from too hard ramming; and second, from the sand being too wet. It may be asked what guidance there is to determine with accuracy what consistency is required? To this I say there is but little, it being simply a matter of continued practice and close observation as to results. A sand that

gives off a perceptible amount of water, or, as it were, sweats the core box in making the core, is certainly not good. Cores made from such sand are dense, difficult to vent, and troublesome to the fettler in coring the casting. A defective loam core may be due to several causes. Two of these may be mentioned—namely, too strong loam (by this I mean a predominance of clay or plastic matter, such substance closing up the most porous of loams); and second, should a core, on receiving the last coat of loam, be wrought to the extent of bringing up a glazed surface, it will tend to cause blistering. In these two classes of cores are to be found that which should be avoided, more especially in horizontal pipe casting; but wherever it exists, if the molder, before black-washing such cores, would simply draw his card along the glazed surface, and destroy it, he need have little fear of the result. There is no necessity for carding the whole core; this roughing of the top side admits a free exit of the gases contained in the core. To those who may have doubts upon this matter, I should like to draw their attention to a contrast of a dry sand and loam core against a green sand one. In using a green sand core, should the core scab, the unanimous opinion would be that too hard ramming was the cause. This is similar to what takes place with a dry sand or loam core that is too hard and glazed on the surface, with this difference—that we get the blister on the latter, while we have the scab on the former; the blister being formed by the unrest of the metal and the strength of the core maintaining its entirety. But were the surface of the core to break away (a thing that never happened in my experience) there would be a scab in the place of the blister, thus clearly showing that blisters or blowholes in such castings are caused by laxity in venting.—A Foreman Molder in "The Mechanical World."

Obituary.

Joseph H. Widdowfield, of the firm of E. C. Bliss & Co., Brooklyn, N. Y., died in that city March 3.

Theodore E. Smith, who for several years, has been connected with the firm of Arnold & Co., at Norwalk, Conn., is dead.

Sir Henry Bessemer, the celebrated inventor of Bessemer steel, died March 15, in London. The deceased, whose name is inseparably connected with the development of the steel industry, was born in Hertfordshire, in 1813. His discovery of the means of rapidly and cheaply converting pig iron into steel by blowing a blast of air through iron when in a state of fusion revolutionized the whole iron trade of the world in the short space of thirty years. At the age of 20 he was an exhibitor in the Royal Academy. Not until 1856, however, did he read before the British Association, at Cheltenham, the paper on the manufacture of malleable iron and steel, which first attracted attention to the very high character of his scientific attainments. In 1870 he was president of the Iron and Steel Institute of Great Britain.

Isaac A. Sheppard, of the well-known stove manufacturing firm which bears his name, died in Philadelphia, March 6. Mr. Sheppard was born July 11, 1827, in Cumberland County, New Jersey, and was a descendant of two of the oldest families of the state, his ancestry dating back hundreds of years on both sides. In 1840 he came to Philadelphia with his parents, and his mother dying shortly afterwards, he was thrown on his own resources, and tried his hand at various occupations, obtaining in his sixteenth year a situation in a brass and iron foundry where he commenced to learn the molders' trade. The following year he became an apprentice in the stove and hollow-ware foundry of Charles W. Warnock & Co., and remained with this firm until its dissolution. In 1859 he joined with a number of others in the establishment of a stove foundry at Seventh street and Grand avenue, under the present style of Isaac A. Sheppard & Co. The business proved so successful that in 1866 a branch was established at Baltimore. In 1871, owing to the rapid increase of the business, the present plant of the company, occupying four acres, at Montgomery avenue and Fourth street, was secured. Mr. Sheppard's death will make no change in the management of the business, as for several years past he has relinquished active participation therein, leaving same to his two sons, Franklin L. and Howard R. Sheppard.

Best Mixture for Babbitt Metal.

What is considered the best mixture for Babbitt Metal? B. A.

Among the Foundries.

The Francis & Mygren Foundry has been incorporated at Chicago.

A new foundry will be erected at Cherokee, Ia., by H. Frambach.

The Kutztown (Pa.) Foundry and Machine Co. will erect a new foundry.

George Middleditch's foundry at Bothwell, Ont., was burned a short time ago.

G. W. Wheland is building an addition to his foundry at Chattanooga, Tenn.

The Jesup (Ga.) Machine & Foundry Co. are preparing to increase their plant.

Fred T. Warfield has commenced operations in his foundry at Gardner, Mass.

The Enterprise Foundry Company, of Belleville, Ill., will enlarge their foundry.

Kreuger & Foster are erecting a new foundry and machine shop at Menominee, Wis.

Edward Boyce has leased the foundry at Oakfield, N. Y., hitherto operated by W. D. Grinnell.

The Pyoss Foundry Company has been incorporated at Chicago with a capital stock of $10,000.

J. A. Record has purchased the foundry at Livermore Falls, Me., formerly operated by E. A. Keene.

Kreps Bros. foundry, at Allegheny, Pa., was damaged by fire March 16 to the extent of $7,000.

Geo. T. Cunningham is reported as contemplating the erection of a foundry at Hattiesburg, Miss.

The Edgar & Nelson Foundry Co., at Mobile, Ala., had their plant totally destroyed by fire March 13.

The Headford Bros. & Hitchins Foundry Company, of Dubuque, Ia., will add a brass foundry to their plant.

The Torrey Roller Bushing Works at Bath, Me., sustained a damage to their foundry of $2,000 at a recent fire.

The Fairbury (Nebr.) Iron Works, operated by John Simpson, are moving into their new shops recently completed.

M. Zier & Co. have been incorporated at New Albany, Ind., with a capital of $25,000, to conduct a general foundry business.

The Pennsylvania Car Wheel Co. are building a foundry 70x263 feet and a machine shop 50x70 feet, at Allegheny, Pa.

Edward Gibson, of Jersey City, N. J., is rebuilding a portion of his foundry, and installing a new crane, operated by electricity.

The Harrisburg (Pa.) Foundry and Machine Co. are preparing plans for the complete rebuilding of their plant, with greatly increased facilities.

Bridgeford & Co., of Louisville, Ky., will erect a new foundry at that place, their old buildings and ground having been purchased by the Illinois Central Ry.

The Geo. D. Pohl Mnfg. Co., of Vernon, Oneida County, N. Y., has been incorporated with a capital of $20,000, to carry on a general foundry and manufacturing business.

The foundry of Patrick Kennedy, located at Charles and Wells streets, Baltimore, Md., was completely gutted by fire recently. The total loss is estimated at about $10,000.

The Southern Iron & Steel Co., of Birmingham, Ala., have commenced operations in their new plant. The company is under the management of I. Adler, and W. W. Barclay, superintendent.

Edward McSherry, who was foreman of the Rockford (Ill.) Foundry Company when this concern was managed by A. W. McArthur, will shortly re-open the works of the old company on his own account.

The William Ferguson Foundry Company has been incorporated at Chicago with a capital stock of $25,000, by William Ferguson, Paul W. Lange, and Fred B. Vogel. Mr. Ferguson is well known to the readers of THE FOUNDRY as the foreman of some of the leading American shops, and also for the interest he has taken in the Western and American Foundrymen's Associations.

The Bonnet-Nance Stove Co., of Quincy, Ill., has closed a contract with the Chicago Heights Land Association for the removal and establishment of its manufacturing business in Chicago Heights, Ill. The foundry building will be 86x450 feet, with a truss roof the entire length of the building. The main building will be 50x800, two stories high, with boiler and engine house attached, which will be equipped with two freight and passenger elevators, electric light plant, and a 200 h. p. Corliss engine, with two boilers. The Chicago Heights Terminal Railway is constructing on the premises a system of railway switches which will enable the stove works entirely to dispense with cartage. The raw material,

such as pig iron, coke, etc., will be delivered on the cupola platform by means of an elevated track, and the finished product will be delivered from the warehouse direct to the cars, thus saving the item of cartage. The building heretofore mentioned will be ready for occupancy by May 1. The officers of the stove works are: J. J. Bonnet, president; R. W. Nance, vice-president; and Lorenzo A. Bonnet, secretary and treasurer.

The Pewabic Founders.

(By Telegraph.)

In calling the last meeting of this association to order, the presiding officer, Pumice De Witt, congratulated the members upon the fact that all industrious farmers in that section of the country had plenty of inside work to do on rainy days.

The president called attention to a framed motto adorning the background of the speaker's stand which read:

A GAGGER IN THE FLASK
IS WORTH
TWENTY IN THE HEAP.

The speaker requested the members to bear in mind these sentiments, as they represented a lifetime's experience in practical founding, and would be found invaluable in producing homogeneous castings in iron, brass and lead.

Col. Phineas Snort wanted to know if blow-holes existing in pig iron could be transferred to a casting made therefrom; in other words, if the disease was contagious and hereditary. He produced a piece of pig iron and part of a casting, both having cavities of similar appearance, and thought that some sort of a relationship existed between the two.

The physician of the association, Dr. Salamander Pierce, C. I., M. D., was instructed to prepare himself to feel the pulse of the suspected pig iron, and to report his diagnosis of the case at a future meeting.

Constant Humpon made a motion that in case the doctor disagreed with himself, he should consult with some respectable clairvoyant who could tell how to make money, and yet never had any.

When the chairman called for reports from committees Wayback Gulliver announced that the committee on apprentices appointed last month were ready to make two reports. It was decided that the minority report should be heard first, and John Gaggerbess, of the Bungtown Agricultural and Bedspring Co., being the dissenting member to the majority report, spoke as follows:

"Your committee finds that the American boy is an idiot of the first water. Having been sent to Sunday school for nine years, and having been told that he must earn his bread by the sweat of his brow, he forthwith begins to disregard this advice by obtaining his living without sweating. Instead of seeking the mental satisfaction which follows the bespattering of one's clothes with claywash; instead of being eager to wear a blue shirt saturated with the moisture of honest toil; instead of seeking that exquisite thrill of having a lot of sand containing 60 per cent of silica rattle down his trousers, this darned cuss of an American boy actually prefers to become a railroad man, or a printer, where he can earn more money with less exertion, and have the chance of wearing a stand-up collar on Sundays. It must be admitted that the man who sweats the most never earns very much of a salary, but your committee would recommend the establishment of missions calculated to instill in the youth of the land a love for the foundry business. There is an evident lack of intelligence in the trade, and in order to obtain this without paying therefor, it will be necessary to adopt legislative means looking toward making our boys do what they do not want to do. Some ignoramus has scattered the report broadcast that the amount of intelligence required in a trade could be measured accurately by the compensation that trade received. This is wrong; because, if true, some of our molders working in car shops and other slaughter houses for $1.35 per day would lack forty per cent of having any intelligence at all."

Wayback Gulliver offered the following as the majority report:

"Your committee finds that one of the chief kickers on the molders' ability of today is Maj. Pocahannis, of the Skinner Company; and in order to form an intelligent decision, your committee has been doing a little investigation on the quiet. We find that several years ago, when the Skinner Company was located at Pewabic that they had no difficulty in securing men who satisfied them. Some time later the Skinner

Company built a new plant at Skinapolis, and it occurred to them that owing to the great amount of free ozone in the atmosphere in that vicinity they should obtain their labor cheaper. Instead of paying their molders $2.50 per day, as had been customary at Pewabic, they wanted them to work for $2.00 at Skinapolis. Ever since the Skinner Company followed this policy they have been complaining of poor molders, and as the reason for this has been traced directly to the fact that they expected to get as good molders for $2.00 as others do for $2.50, and as this is in violation of all rules of arithmetic, your committee recommends that no sympathy be extended to the Skinner Company at this time.

"The Bulldozer Company, of Paradise Flat, is another concern of the heavy-weight class who assert that molders are nothing like they used to be. We find that this company has specialized its product on the principle that a molder who is kept on one job will produce more than the molder who is continually being shifted from one class of work to another. This is sound reasoning, with which we find no fault; but when this company took a contract for general castings last month, and kicked because their molders, who had never worked on more than one thing, couldn't jump from one thing to another, your committee finds that this result should have been anticipated, and in our judgment said company stands guilty of talking through its hat. If a company does not teach its molders anything, how can they expect them to know anything?

"We find that John Gaggerless, of the Bungtown Agricultural Works employs nothing but Polacks, who average $1.53 for seventeen hours' work. Further comment as to why Mr. Gaggerless believes the present molder has degenerated is superfluous.

"The Whackdem Iron Works presented a case that was somewhat difficult of solution. They have a pretty good class of work, and are evidently sincere in their belief that the molder should be improved upon. Your committee finds, however, that the reason this company does not receive a larger income upon its investment is on account of bad management. Their foreman runs the shop and a floor of his own besides for $13.51 a week, which explains why their foundry department comes out at the small end of the horn. We would recommend that this company obtain a foreman who is worth $51.13 a week, and that this be paid him for running the shop, and not for putting up the biggest day's work. It may be a good thing to have a pacer, but the foreman should not act in that capacity regularly.

"The Rainbow Chaser Company, of Pumpkinville, offer to make affidavit to the fact that their molders know nothing. Your committee finds that their foreman receives $180.00 a month, when he is not worth that many cents as an ornament. This condition is brought about through him having married the niece of the company's president, Mr. Sublime Cannon's first wife. We would advise that Mr. Cannon dispose of the idea that it is a good thing for a manufacturing concern to keep all the good jobs in the family, or to appoint as foreman anybody with a pull, or who has similar blood in his veins. The salary paid a foreman by this company is all right, provided they pay it to a man who earns it. Nothing like a little competition in filling a foremanship, while a family trust should be tabooed altogether."

After hearing the committee report, Constant Humpon offered the following resolution, which was agreed to:

"Resolved, That a molder is just what his employer makes him, and that anybody who finds fault with the skill of his molders will find the root of the evil right on his own premises. Let him act accordingly, or else tell his troubles to a policeman."

The president announced the appointment of the following gentlemen as a committee to investigate the effect of ignorance, and its relation to the manufacture of scrap: D. Oxide Bosphorus, chemist Bulldozer Co., Paradise Flat; Dr. Salamander Pierce, C. I., M. D., and Henry Bessemer Molecule, of Huckleberry Run.

After adjournment the members repaired to the cafe, where they partook of a Chinese dinner a la fifteen cents, consisting of bird's nest soup and roast pork. It will readily be seen that these repasts have resulted in the dispensation of much information to the foundry men of the country by aiding the digestive powers of those foundrymen who in their everyday life are in the habit of biting off more than they can chew.

Personal.

John J. Glady has assumed charge of the Massey Harris Toronto Foundry, in place of V. L. Wolfe, resigned.

Davis P. Gray, for many years foundry foreman for the Whitin Machine Works, has been appointed postmaster of Whitinsville, Mass.

Mont Anderson, for some time foreman of the foundry of the Hayes Pump and Planter Co., at Galva, Ill., has accepted a similar position with the Peters Pump Co., at Kewanee, Ill.

A. W. McArthur, one of the prominent members of the Western Foundrymen's Association, and president for one term, has formed a partnership with A. Sorge, Jr., to handle the high grade steam specialties for which Mr. Sorge has been agent for several years past. The firm will do business under the name of A. Sorge, Jr., & Co., with offices at 1020-1021 Monadnock Block, Chicago.

American Foundrymen's Association.

The annual convention of the American Foundrymen's Association will be held in Cincinnati, June 7, 8, 9 and 10. Reduced rates have been obtained from all parts of the country.

A number of papers of more than usual interest will be presented for discussion. We will announce the titles of these in our next issue.

Some Cast Iron Opinions.

At the March meeting of the Western Foundry Association a general discussion took place, from which has been condensed what appears herewith. Mr. West communicated the following: I wish to enter a protest against the claim that it is essential in analysis of pig irons to include the carbons with the other metalloids. I believe that in foundry pig iron, carbon can generally be wholly ignored. The state of the carbon, whether graphitic or combined, in any brand of pig metal, is chiefly regulated by the rate of cooling as it is cast at the blast furnace. Suppose a blast furnace when tapped had its stream directed to two different channels, one leading to the ordinary sand bed and the other to "chills," or iron molds. Analyses would show the carbon in the chilled or sandless pig to be largely combined, while in the sand pig, the graphitic would be in excess of the combined carbon. If we are to be guided by the carbons .the chilled or sandless pig would be graded as an iron to make hard castings, while the sand pig metal would be set aside for soft castings. The fact is that the chilled pig would give, if anything, a softer casting than the sand pig. Of course this illustration is the extreme of what may be expected in the carbons of pig iron, coming from one "cast." Nevertheless, pig irons of the same grade, cast in sand, from one or more "casts," vary widely in their carbons, due to the variations in the fluidity of the metal as it comes from a furnace, and its rate of cooling in the sand beds, also to differences in the size of the pigs. What is necessary is a knowledge of the silicon, sulphur, phosphorus and manganese contents of the pig metal. The different percentages of these four elements, as a rule, regulate grades in pig iron, where we are guided by analyses; and the carbon can be almost wholly combined or graphitic and still be ignored, as intimated above, in calculating foundry mixtures. If it were true that the carbons could indicate the true grade of pig metal, then all claims of our inability to define correctly the grade of pig iron by its fracture, and of the great value of analyses in making mixtures of iron, are fallacies.

Mr. Sorge said: The claim has not been made that the condition of the carbon in the pig metal is a true guide to its character, but that the total amount of carbon in that metal will affect the character of the castings that are produced. In other words, the larger the amount, the greater the influence of the different metalloids on that carbon. Now if you omit carbon from the series of elements to be ascertained in pig iron, you are omitting the element which really makes pig iron and really makes cast iron; the fact being that carbon contained in iron produces the cast iron, while the various metalloids are simply the agents in influencing the condition of that carbon. And the amount of carbon actually contained in the iron is as important to know as it is to know the amount of these various metalloids or metals that influence its condition. As an illustration: In the manufacture of malleable castings it has formerly been held that the malleableizing of iron was due to decarbonization. The facts that have developed in the last few years have shown that this is a fallacy. And it has further been found by the manufacturers of malleable iron that very rich carbon irons are the very best irons to be employed in the manufacture of malleable castings. There are now some fur-

naces that are manufacturing iron, in which the total amount of carbon contained goes up as high as 4.3 per cent, which is something unusual in the way of ordinary pig metals. And this iron, a coke iron, by the way, is one of the very best metals that can be employed in the manufacture of malleable castings. This shows that the amount of carbon contained in the iron is as influential in the grading of iron, or in varying the quality of the iron for the purpose for which it is to be used, as the other metalloids. Carbon is the most vital thing in the iron, the absolutely vital thing. Some one has said that the carbon carried the heat. I thing a little better explanation of that would be that the higher the carbon contents of an iron, the greater its fluidity; it doesn't carry the heat, but it will melt at a somewhat lower temperature than iron with a small amount of carbon in it, and therefore will hold its fluidity longer than an iron which is poor in carbon. Furthermore, in malleableization, the effect of high carbon seems to be an easy separation of the carbon from the iron during the process of annealing. The iron seems to be more easily annealed with high carbon than with low carbon contents. Now the effect of carbon of gray iron is known to all of us, that is, the higher amount of carbon the finer we can make our castings, into the finer grooves can we run that iron, the longer will it hold its heat, the fact being it is more fluid, and the iron is in every way a more valuable iron, except for special purposes, those in which we want to produce an iron having very small carbon contents. Therefore I think that the matter of the carbon contents of the iron should be given more careful consideration.

Mr. Dowell said in part: There is a difference between the value of pig metal and the value of the fracture to indicate what that iron is. There is no question that, if you are going to grade by the fracture the amount of carbon in the iron doesn't cut any figure at all, but when you come to buy the pig iron the amount of carbon does cut a good deal of a figure, because carbon is the life of iron. Malleable castings are to be made out of the very hottest metal that can be made, and carbon is what carries the life, and so we put the iron in the furnace to desiliconize it, and in doing so raise the heat. But if there isn't carbon there it won't carry it, and so it is that iron that has the largest amount of carbon in it is the most desirable for making malleable castings. It doesn't follow because that is so that that is going to show anything in the gradation of iron by fracture. It doesn't make a particle of difference whether the iron is cast in the sand or cast in the mold. It will affect the fracture, but it will not affect the chemical constituents of that iron. Now I leave out carbon because carbon doesn't regulate the price of iron. It regulates the value in special cases. I say nothing about manganese or phosphorus; they regulate the value of a certain grade of pig metal to a man for special castings. It is a fact that today iron is bought and sold on account of its silicon contents, less the effect that the sulphur will have on it. I don't go back at all upon the value of carbon or manganese, or the value of phosphorus—all these for special purposes—but I am speaking about gradation of metal. We grade it, and silicon is the thing that regulates the value of pig metal to the foundryman because it will carry more or less scrap. Carbon gives heat and fluidity, there is no question about that; and you can add to fluidity by adding silicon to the iron. But when a man gives you a list of metals, the first thing you look at is silicon, and the sulphur next. Then the question is, where is your manganese; and if you are in a certain grade of castings, where is your phosphorus? All those things follow as a matter of course; it depends altogether upon what the castings are. A man will give the preference to the pig iron that has that element in it that he specially wants, but the value of the pig metal is entirely regulated by the amount of silicon in it, and that is a good standard. There isn't anything that will so educate the foundrymen as to have them work over that proposition; and I think some foundrymen could afford to spend some money in that direction to know what sort of pig metal they want for their castings.

Correspondence.

WHY DOES THE LINING BURN OUT?

Editor The Foundry:

I have a cupola 32" inside, six tuyeres 2½" diam. From about 6" above the tuyeres up to 18" it seems to be impossible to keep the lining from burning out. Having bought the very best brick in the market without securing any better results I should like to have some of your readers offer their suggestions as to how this condition of affairs can be improved. P. O.

MIXTURES FOR PULLEY CASTINGS.

Editor THE FOUNDRY:—

We have noticed an article in the March number of THE FOUNDRY by E. J. Jordan, "Mixtures for Pulley Castings."

To give the number of pounds in a mixture of certain brands of iron is of very little value from the fact that the irons are changing, one lot from another, and might be very unsafe to follow. If the analysis of the iron had been given by Mr. Jordan that would have been something that could be followed: whether they use Hamilton iron or any other iron would not make so much difference. It might not be convenient either, in all parts of the country, to get Hamilton, Cherry Valley, or any other special brand; but if the analysis is given, so that one could make the mixture, it could be obtained in any part of the country. If some of your correspondents could give formulas of this character it would help every one.

BROWN & SHARPE MFG. CO.,
R. VIALL, Supt.

TESTING CAR WHEELS.

Editor THE FOUNDRY:—

In an article under this heading, in your issue for March, much stress is laid on the fact that the wheels referred to, stood the same tests as the steel tired wheels used abroad. That this is in itself no proof of superior quality, as cast iron wheels, will appear, when it is remembered that the steel-tired wheel of Europe has a wrought-iron, or steel body or centre, and that blows on the tread test the tire rather than the whole wheel, detecting in the former undue hardness, or too tight fitting.

To apply the same test to a chilled wheel, is simply to crush or break the tread to pieces, as shown in the illustrations in a previous article, while very little of the force of the blow reaches the body of the wheel. And in practice when the track is in good order, wheels are more liable to break from sidewise, than from vertical blows, besides having to resist the expansion due to brake-heating.

A. Whitney & Sons, of Philadelphia, abandoned the tread blow in 1850 for the above reasons, substituting a side blow against the hub. If the metal is hard, or there is any cooling strain on the casting, this test is far more sure than the other to find it. Transverse tests were also regularly made of the strength of the grey metal, and after 1888 of the chilled metal.

It should also be noted that the weights of the wheels mentioned are 15 to 90 per cent. greater than those usual here.

Of the three kinds of tests—crushing, tensile and transverse—the two latter have been found to be the best for cast iron wheels. The hub blow, now formulated into the "drop" test is a practical application of the transverse, as the "thermal" is of the tensile.

I believe that the cast chilled wheel, made as it should be, with at least as much chemical care as the steel axle on which it is fitted, is far more efficient and economical than the steel-tired wheel, but it is (and has been) better shown by practice, than by tests which do not "prove"—at least for the home trade.

J. S. W.

Profitable Communicativeness.

Competing industrial establishments, if their contemporaneous existence is prolonged, must fight on nearly equal terms. No pronounced and permanent superiority can reside with either. There must be, with both if with either, a constant effort and a consequent tendency to advance. One may gain an advantage by aggression, or, as they say in warfare, offensive devices, but if so the other must quickly meet and parry them defensively. The plane upon which the struggle is carried on matters little, and least of all to those most seriously engaged. The employer can pay high wages as well as low wages as long as his competitors must do the same. He can afford to be slack and careless if others are equally so. The new process or the improved machine may not interest one until he finds them advantageously employed elsewhere, but then he must be alert to adopt them. It may be possible to be satisfied to do as well as our neighbor, but there is no safety in anything short of that. To have a fighting chance conditions must be nearly equal.

There are those who, in the above view of the case, are unable to understand how American shops can be run in such an open and public way as they are. It is well known to all the world that American manufacturers have few trade secrets, and that they are very free to let each other, or to let anyone who wants to, see what they are doing and how they are doing it. It is carved in stone over the doorway of the Straight Line Engine Company, "Visitors always welcome."

This marks an admirable personal characteristic of Professor Sweet, but it is also largely characteristic of American shop proprietors everywhere. The attitude is instinctive and spontaneous and does not come of any conscious planning, so that there may be in it little to boast of.

We hope to see the practice continue without the slightest diminution. We cannot in fact afford to give it up. There may be some apparent advantage in having shop secrets and in keeping them to ourselves, but it works both ways. If it works for the good of any individual it also works against him. No one man and no one firm has a monopoly of enterprise or inventive faculty, or of the advanced means and methods developed by them. If we choose to work on the lower plane of going it alone, and of never letting our neighbor know our best way of doing a certain thing, he can play the same game and also keep his ways and means all to himself. The practical result of the general adoption of the narrow and selfish practice would be that neither would possess any advantage over the other, any more than under our more liberal policy, but that each would be less expert and less productive and distinctively lower when it came to world-wide comparisons and to competition in the open market of the world. We have been distinctly the gainers in taking the liberal course, and stand firmer and on higher ground by reason of it. Mutual liberality has been reciprocally helpful. We have all around each lifted the other. It is to be hoped that we will never fall into the old world habits of guarding trade secrets and maintaining trade jealousies. It does not look well and it does not pay.—(American Machinist.)

Chemistry in Foundry Practice.

"A little learning is a dangerous thing," is a saying which will apply very well to both the chemist and the foundryman. The former may have spent years in study of the theoretical effects of the different elements, and may be thoroughly conversant with their relations to each other, and the proportions in which they may combine, writes "Ferro" in the Industrial World. But when he comes to take his place in the foundry and has only a slight knowledge of the practical workings of the cupola or furnace, as the case may be, it becomes necessary for him to obtain an entirely new course of instruction in foundry practice, and he is apt to fall into the mistaken idea that it can be attained in a year or less. Whereas it has cost the practical foundryman years of study and hard work to reach the same by watching the different rules of cause and effect. On the other hand, the foundryman, after having spent many years successfully in melting and mixing irons, upon acquiring a few theoretical ideas as to the effects of the different metalloids upon his mixture, is apt to fall into the very common error of overdoing the use of some one or more of them as a cure-all. He would have done better had he stuck to his old methods of constant watch of irons, changing the different brands as change became necessary.

There is no question as to the value of chemistry in the foundry, but the foundryman should have a knowledge of all the metalloids in his mixture, and should be able to make them up from the analysis given him by the chemist. Where such is the case, the chemist will find he has plenty to do, and will have earned his salary, at the same time his employer will have reaped the benefit. In this manner the foundryman and the chemist will go along hand in hand, working for a common end—successful mixtures.

In most cases to-day, the chemist, in coming out of school, university or college, and getting a situation in some institution where he may see iron charged and melted for probably a year, begins to look around for a position where he may attain greater honors, and also the necessary increase in salary. Having obtained it, the first thing he is likely to do, is to criticise the manner in which the iron is charged, melted and handled, not knowing what great differences in methods are required for different lines of work. The result is, before long he is assuming the duties of the foundryman, causing dissension, and conveying the impression to the managers or superintendent that the chemist's modern ideas are being interfered with, and generally winds up in changes disagreeable to all parties concerned, and to the credit of neither.

Now on the part of the foundryman who has no knowledge of the effects of the different metalloids, he is very apt to have the idea that a "doctor" is not needed in his business, and begins by putting every straw

he can in the way of the chemist. If the results are not obtained immediately, he is very quick to ridicule the ideas of the chemist, and forces him, as a matter of self-protection, to usurp the duties of the foundryman with the same general results spoken of above.

The writer favors chemistry in the foundry, but the chemist must assist the foundryman and the foundryman must obtain the necessary knowledge and assist the chemist, otherwise there will be failure to all concerned.

"Sand Glue" for Molds.

BY ROBERT GRIMSHAW.

In a German foundry I recently came across a mode of practice which was decidedly new to me and which was so highly spoken of that I describe it for your readers.

It consists in the use of a glue-like composition with the molding material, whether for green sand or for dry sand work, by the aid of which not only old sand, but the scrapings of castings can be used with the addition of but 10 per cent. of new sand. The foundry in question has used this method for about one and one-half years and for pieces up to 44,000 pounds in weight.

In using the "glue," which is ground to about the size of cracked wheat, for each kilogram (2.2 pounds) 12 liters (3.43 U. S. gallons) of water are used; the glue being sifted slowly into the water, so as to get thoroughly wet through—not form lumps or cakes. When thoroughly dissolved, the solution is used in the proportion of 60 kilograms (132 pounds) to 10 wheelbarrow loads (about 850 kilograms), or say 1,870 pounds of old sand, including that resulting from casting-cleaning, 75 kilograms (165 pounds) ground hard coal and one barrow load (say 187 pounds) new sand. The solid materials are well mixed up with the shovel and spread out about eight inches deep and watered with the solution through a sprinkling-pot—after first being superficially sprinkled with water to make the glue solution sink through better. After the mixing with the shovel the material is next run through a rattling barrel, or other machine, to insure more perfect intermixing of the solid ingredients with each other and with the glue solution.

The foregoing directions are for green sand work. For dry sand molding and for cores the same procedure is necessary, except that instead of the coal dust another wheelbarrow load (say 187 pounds) of new sand is used.

The founders say that poor sand is by the use of the glue solution brought up to a high standard and that after extended use the proportion of coal dust can be reduced, and its use eventually dispensed with.

In molding, harder ramming is permissible and less venting is necessary; also many castings can be done by green sand molding, for which formerly dry sand was necessary.

For facing molds, a powder of nine parts by weight of coal dust and one of the finely ground "sand glue" is used. (Our correspondent is evidently mistaken here, or else refers to the blacking of molds.—Ed.)

For "slicking" sharp edges and corners, instead of water the clear yellow "sand glue" solution is used; and the solution is also used instead of water in making black facing.

One hundred kilograms "sand glue" is figured as enough for 17,000 to 20,000 kilograms of dry molding sand.

(While we have no desire to deny the ability of our German friends to increase the cohesiveness of their burnt-out molding sand by the addition of glue, it should be noted that they also use 10 per cent. of new sand at the same time. The whole question of using old sand is simply one of cost and sounds something like this: Which is the cheapest, to let old sand be thrown away and add new sand to the heap, or to buy glue and reduce the amount of new sand? The answer to this question will naturally differ with localities and depends upon the ease with which new molding sand can be obtained. However, we do not believe that the majority of our foundries will find any great saving in using glue in place of sand.—Ed.)

Not So Short After All.

Short Process for Annealing Cast Iron.

The process which has been commonly employed for annealing iron castings is to insert the castings in pots and to pack them with iron scale, the pots then being inserted in an iron furnace in which the annealing is accomplished. There are several objectionable features in such a process, among

which are a great expenditure of time to obtain an annealed condition of the castings and the employment of a vast quantity of pots which deteriorate very rapidly in use and soon become worthless. The King Annealing Process Co., of Belleville, Ill., has patented a new method by which the process is much expedited. The castings are treated to a coating of tallow or beef suet and a coating of powdered ferromanganese on top thereof and are then introduced in a covering or mold made of refractory material such as silicious sand. Within the covering and surrounding the castings there is placed a quantity of sawdust or charcoal that will be fired by the heat of the furnace, and also sufficient turpentine and vinegar to render the mixture thoroughly moist. The proportions of material are usually 5% of tallow, 5% of ferromanganese (the alloy has 80% manganese), 10% of sawdust, and the balance turpentine and vinegar. Large castings, however, require larger percentages of the coating materials. The temperature required for the annealing is a soft white heat, and after it has fully penetrated the castings the latter are allowed to cool. The process is especially adopted for cast iron wherein the carbon is combined, and it is found by experimenting that in the treatment of the iron the carbon is not destroyed nor is the iron robbed of any of its constituent parts, but the structure is changed rather by changing the condition of the carbon in the material. The theory upon which the improved process seems to depend is that the surrounding material acts as an oxygen-neutralizing agent.—Exchange.

Which Part of the Metal is the Heaviest?

In describing the casting of rifled mortars at the Builders Iron Foundry, Providence, R. I., the Boston Journal says:

The surface of the metal as it enters is stirred to prevent the "scoria" from lodging, care being taken to prevent a swirl, which throws the lightest metal around the core, where the heaviest and best should be. When the mold is filled the tap holes of the furnaces are closed, and the surface of the metal in the shrinking head is covered with a layer of charcoal to prevent its chilling.

THE FOUNDRY is one of the necessities of life to foundrymen.

J. F. BROWN, Chester, Pa.

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Answers addressed to our care will be forwarded.

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The National Jeloluse Co., of 547 W. 43rd street, New York City, well known as the manufacturers of "Jeloluse" have placed on the market a new core compound under the name of "Coreine." Besides being cheaper than flour or rosin, other advantages are claimed for this product, chief of which is its ability to prevent the absorption of moisture by the cores and the consequent imperfections in castings resulting from this defect. The manufacturers offer to send free samples to anyone interested in improved coremaking.